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Cost-Benefit Analysis of the 2006 Air Force Materiel Command Test and Evaluation Proposal

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Preface

This monograph provides the results of a cost-benefit analysis (CBA) of an Air Force proposal to consolidate and divest itself of a portion of its test and evaluation (T&E) facilities and capabilities. Congress directed the Air Force, in the 2007 Defense Appropriations Act, to study the effects of this proposal, and the Air Force asked RAND Project AIR FORCE to carry out the analysis. This monograph should interest those associated with military T&E facilities and capabilities.

The work documented here was part of a fiscal year (FY) 2007 project, "United States Air Force Test and Evaluation Infrastructure Assessment."

RAND Project AIR FORCE

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Summary

As with other military services, the Air Force must recapitalize its equipment, which is an expensive undertaking. In 2006, to make additional funds available for recapitalization, the Office of the Secretary of Defense issued Program Budget Decision 720 (PBD-720), which directed a $6.2 billion reduction in support contractors over FYs 2007 through 2011. Air Force Materiel Command's (AFMC's) share of this reduction totaled $839 million, of which $371 million was T&E's share. To meet the $371 million budget objective, AFMC considered several options. One of these options, referred to as the "Organizational Streamline Approach," focused on the consolidation and potential divestiture of U.S. Air Force T&E facilities and capabilities. This option was included in the FY 2008 budget process. The option proposed three things:

- consolidation of the 46th Test Wing at Eglin Air Force Base (AFB), Florida, with test organizations at Edwards AFB, California, primarily the 412th Test Wing[1]
- full or partial divestiture of seven Air Force test facilities
- reduction in the T&E range capacity at Eglin AFB.[2]

Congress, in the 2007 Defense Appropriations Act, directed the Air Force to study the potential costs and benefits of this option. The Air Force asked RAND Project AIR FORCE to help conduct the CBA.

Project Scope and Approach

The boundaries of this work were purposefully limited to the AFMC proposal articulated above. We did not propose ideas that we deemed to be more efficient or more effective than the alternatives presented to us for analysis. This was consistent with the direction that we received throughout the project from congressional staff and in discussions with personnel from the Air Force and the Test Resource Management Center. Specifically, we were asked to assess, in terms of the spirit and intent of the language in the appropriations act, the specific set of pro-

[1] Test personnel supporting command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); the Air Force Special Operations Command (AFSOC); and the Air Force Seek Eagle Office (AFSEO) were expected to remain in place at Eglin AFB.

[2] Air Force organizations that were asked to implement this proposal inferred that this also meant preserving some ability to support deployed flight testing, if necessary. This assumption was the foundation on which Eglin AFB provided data to RAND for this analysis.

posals and the alternatives that AFMC had articulated. The only addition to the AFMC proposal that RAND considered was whether Edwards AFB and the Navy installations at Point Mugu and China Lake could accommodate the flight- and ground-test workload from Eglin AFB. Although the AFMC proposal did not specify explicitly, it did imply that, if the PBD-720 cuts significantly affected the Eglin range, the Air Force would need to conduct these activities elsewhere (e.g., Edwards AFB and the Navy range and facilities).

We drew our data from three primary sources. First, we visited the installations and other organizations the proposal would affect. In all, we interviewed over 200 people. Next, at each site, we collected data about facilities and range function and use, maintenance activities, flying hours, and so forth. Our third source of information was a review of the literature.

After collecting relevant data for the study, we constructed financial analyses that captured the economic benefits and costs of the proposal. Data were provided by the organizations that the AFMC proposal would affect, including test facilities, the test center staff, and customers. One key assumption of our work was that the demand for test-program content would remain constant. This meant that customers of Air Force T&E that were affected by the AFMC proposal would still have a requirement to test and would therefore require the capability to do so. This assumption ensured that we captured relevant alternative effects. Although we attempted to quantify T&E issues as much as possible, we were not able to do so in several cases. In these cases, we qualitatively assessed the potential for benefit or cost. The results of the economic analysis were compared with the qualitative findings to draw conclusions.

Results

Consolidation of 46th Test Wing (Eglin) with the 412th Test Wing (Edwards)

We analyzed the cost-benefit effects of a consolidation of the 46th and 412th Test Wings in three areas: their flying hour programs, maintenance functions, and support structures. With respect to the maintenance and staff support consolidations, we also analyzed how the movement of the 46th Test Wing would affect the 53rd Wing at Eglin, which has a combined maintenance function and combined test force (CTF) with the 46th Test Wing. The Future Years Defense Program (FYDP) savings from this consolidation are projected to be $43.2 million in current-year dollars. This savings includes the types and amounts of costs that the 53rd Wing would need to recapitalize its maintenance capability. Table S.1 summarizes our results.

Range Closings

We also drew conclusions about ground and open-air range (OAR) flight-test activities. With respect to ground ranges, we analyzed eight facilities that were dedicated primarily to ground tests on the range. In its original proposal, AFMC had not intended to close any facilities beyond those it had explicitly identified in the original options. AFMC was therefore unaware that reducing the range capacity would force the closure of ground-range capabilities—RAND uncovered these potential consequences during the early stages of the CBA.

Table S.2 summarizes the results. Because of the many uncertainties involved, we do not attempt to produce a total cost or savings for the entire set of facility closures. In general, there is no compelling reason to treat all these facilities as an indivisible whole; different cost-effective outcomes can be found for each.

Table S.1
Summary Chart—Unified Set of Cost Accounts ($M)

	Annual Savings	Annual Costs	Total Annual Savings	Nonrecurring Costs	Cost Savings Over FY 2007–2011 FYDP
Total for all 46th Test Wing consolidation[a]	71.7	30.4	41.3	58.3	43.2
53rd Wing total[a]	0.0	30.4	(30.4)	0.0	(91.2)
53rd operations support[b]	0.0	3.5	(3.5)	0.0	(10.5)
53rd maintenance					
53rd flightline[b]	0.0	15.6	(15.6)	0.0	(46.5)
53rd backshop[b]	0.0	11.3	(11.3)	0.0	(33.9)
Combined 46th and 412th flightline maintenance[c]	27.5	0.0	27.5	8.6	53.4
Combined 46th and 412th maintenance, backshop[d]	3.8	0.0	3.8	40.1	(28.6)
Flying hour program[e]	3.1	0.0	3.1	0.0	7.3
Support staff[f]	37.3	0.0	37.3	9.6	102.3

[a] These totals include flightline scenario 2 and backshop scenario 1, as discussed in the maintenance section of Chapter Two.

[b] See Table B.12 for supporting information. Not included in AFMC plan.

[c] See Table B.11 for supporting information. AFMC's planned reductions are not used in the RAND analysis and are explained further in Chapter Two. Two scenarios for cost reductions are provided in the text. The first maintains the current ratio of maintainers to aircraft using AFMC's direction to excess three F-16 aircraft as a result of consolidation.

[d] See Table B.8 for supporting information. AFMC's planned reductions are not used in the RAND analysis and are explained further in Chapter Two. The current ratio of maintainers to aircraft is retained as workload is consolidated, using AFMC's direction to excess three F-16 aircraft. Nonrecurring costs include civilian recruitment, reduction to contractor workforce, support equipment moving costs, and military construction.

[e] See Table 2.2 for supporting information. The RAND analysis partially rejects the AFMC plan, as explained further in Chapter Two. The savings generated are less than AFMC and driven by the AFMC plan to reduce three F-16 aircraft.

[f] See Table B.5 for supporting information. The RAND analysis partially rejects the AFMC plan, as explained further in Chapter Two. AFMC's savings appear to be overstated. RAND calculations are based on a 30-percent reduction of support staff as a combined operation, as opposed to AFMC's 40-percent reduction.

The Air Armament Center (AAC) provided specific additional program costs for only two of these facilities: the BISS, at $50 million nonrecurring, and the HTF, at $5.12 million over the FYDP. However, these estimates are simply for recreating the facilities and so are not particularly informative for estimating additional costs to users. Although we do not have specific program costs for the other facilities, we do have a total for programs that use ground-test facilities. This can be compared to the total cost or savings of closing these facilities, as shown in Table S.2. The AAC estimate for three years of costs (2009, 2010, and 2011) following closure is $85.44 million. If we subtract the already considered BISS and HTF facilities, the additional costs total $30.32 million.[3] From Table S.2, the total for the remaining six facilities is a cost, not a savings, of $7.37 million. With the additional program costs of $30.32 million,

[3] Two large programs, Large Aircraft Infrared Countermeasures and Other Infrared Countermeasures, account for $18.29 million of the total.

Table S.2
Costs and Savings Calculations for Proposed Facility Closures (FY 2007 $M)

	Nonrecurring Costs	Annual Costs	Nonrecurring Savings	Annual Savings	Total Savings Over FY 2007–2011 FYDP
Base Installation Security Systems (BISS)	3.91	0.00	0	4.37	9.2
Gunnery and Ballistics Test Facilities (GBTF)	19.45	0.36	0	1.55	(15.9)
HELLFIRE Test Facility (HTF)	0.69	0.00	0	0.91	2.0
Kinetic Energy Munitions Test Facility (KEMTF)	1.36	0.85	0	0.82	(1.4)
Operational/Functional Ground Test (OGT/FGT)	0.60	0.00	0	0.45	0.77
Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF)	1.84	0.00	0	3.24	7.9
Simulated Test Environment for Munitions (STEM)	0.76	0.12	0	0.27	(0.3)
Static Munitions Test Arenas (SMTA)	0.36	0.16	0	0.82	1.6

the cost of closing all six facilities would then total $37.69 million. This option is clearly not cost-effective. Note, however, that this does not preclude the cost-effectiveness of selected facility closures. Individual savings may be large enough and additional program costs small enough to make closure cost-effective despite this aggregate result.

In summary, closing BISS could produce good returns, but the results are misleading because of the lack of data on the costs of equipping alternatives and on possible additional costs to testers. More analysis is necessary. Transferring all costs to the limited number of test program users, as is already under way, is the most likely solution for reducing AFMC costs, but the overall cost to the Department of Defense (DoD) would remain unchanged. Even if DoD did obtain a cost benefit, AFMC is simply shifting costs to other parties. When this occurs, it shifts a portion of the burden created by PBD-720.

Closing PSSSEF and SMTA would likely produce a cost benefit for both AFMC and DoD. Closing GBTF, KEMTF, HTF, OGT/FGT, or STEM would offer little or no cost benefit, even with current cost and savings estimates. The HTF may be another good candidate for single-user status with its U.S. Army users, although this would simply transfer costs and not result in savings for DoD as a whole.

With respect to OAR flight-test activities, a savings of $149 million over the FYDP is possible.[4] To inform this assessment, several stakeholders from Eglin AFB, Edwards AFB, Naval Air Warfare Center (NAWC) China Lake, and NAWC Point Mugu met to understand what types of flight operations could be conducted if OAR activities moved from Eglin to the western test ranges (WTR). This exercise specifically addressed capability (not range capacity) and

[4] See Tables S.3 and C.12 for details. Two areas of uncertainty are whether the Navy can really support additional activity at the WTR with the staffing it estimates and whether the Air Force would really decide to reduce the Eglin range by 689 positions. In Table C.11, we present a case in which the Navy's staffing requirement is three times higher than in the base case and the Eglin range retains 748 staff, rather than the 509 staff retained in our base case. In that scenario, FYDP savings decrease to $78 million.

was predicated on 17 weeks of actual flight testing at Eglin. The stakeholders' results showed that Edwards AFB and its range could not support the entire Eglin workload of this 17-week period. However, the combined capabilities of the WTR—specifically, Edwards, the Point Mugu sea range, and China Lake—could support almost all the Eglin workload, except possibly the telemetry. In the exercise, all the sorties were launched from Edwards. Sixty percent of the missions could be completed with Edwards capabilities alone. Twenty percent required additional support from the Point Mugu sea range, and another 19 percent also required additional support from China Lake and the R-2508 complex. About 1 percent required support from other ranges, such as White Sands Missile Range. Moving the Eglin open-air developmental testing would provide an opportunity for the Air Force to save substantial resources. These savings come from (a) test wing staff consolidation and (b) increased OAR efficiency.

The range activities cannot be shifted to the WTR in isolation or without risk. Movement of the OAR flight testing to the WTR must be linked with the consolidation of the 46th and 412th Test Wings, and in this light, the costs and benefits of range consolidation and wing consolidation can only be considered together. Wing consolidation can succeed only if the Navy supports expanded Air Force activity at the western Navy ranges. This consolidation of both wing and OAR flight-test activities would require significant planning and transition to minimize the effects on the customers. See Table S.3 for an OAR test summary.

Facility Closings

Our analysis of the seven facilities outlined in the AFMC proposal leads us to conclude that the Air Force should not divest itself of these facilities,[5] with two exceptions: the National Full-Scale Aerodynamic Complex (NFAC) and the Joint Preflight Integration of Munitions and Electronic Systems (J-PRIMES). NFAC, a wind tunnel, is a specialized facility that few Air Force customers use and that has little direct benefit for the Air Force. J-PRIMES allows test-

Table S.3
Cost Estimate Summary for Range Consolidation

	Eglin	Edwards	China Lake	Point Mugu	Total
Number of employees	(698)	64	10	5	(619)
Cost per person ($000)	91	100	91	100	
Personnel transition costs ($000)	12,676	3,200	454	250	
Other transition costs ($000)		1,000	250	100	
Recurring costs ($000)			70		
Total transition costs ($000)	12,676	4,200	704	350	17,930
Total recurring costs ($000)	(63,378)	6,400	978	500	(55,500)

NOTE: All costs are in 2007 dollars.
Summary over FY 2007–2011 FYDP: (148,572).

[5] These facilities should not be confused with the ground-range facilities articulated in the previous paragraph. The facilities referred to in this case are those that AFMC explicitly specified in its proposal.

ing of aircraft with radio frequency sensors and emitters in a simulated threat environment to exercise new and updated software. This facility is relatively inexpensive and is valuable for Army testing and flight-test programs at Eglin. However, if most flight testing is moved to the WTR, it would make sense for the Air Force to transfer the activities it does carry out at J-PRIMES to its Benefield Anechoic Facility or to the Navy's testing facilities at Patuxent River Naval Air Station (NAS), Maryland, and to transfer J-PRIMES to the Army. For the other five facilities considered, we concluded that either (1) the facilities' capabilities were too unique to allow their closure and that there was no adequate substitute or (2) customer costs would likely outweigh any savings if the facilities were closed. Table S.4 summarizes the results.

Risk

Throughout this document, we highlight potential risks for the Air Force and DoD of implementing the AFMC proposal. In the aggregate, these risks are not trivial and indicate that the Air Force needs to study the details further and needs to develop an understanding of how the plan would affect customers, test organizations, and DoD. When possible, we include relevant and validated customer effects, in terms of the costs programs may incur. Admittedly, these costs do not include those for classified programs—more analysis and a change in the classification of this document would have been required to consider them.

We also discuss the risks associated with the consolidation of the 46th and 412th Test Wings and the transfer of OAR flight-test activities to the WTR. In both cases, significant coordination would be required to prevent testing from being hampered. The Air Force would need to work out details on how to merge the wings effectively. At the time we conducted this

Table S.4
Summary of Facilities Closure

Facility	AFMC-Proposed Action	RAND Findings	Comments
Central Inertial Guidance and Test Facility	Close or divest	Retain	No practical alternatives Broad customer base
Guided Weapons Evaluation Facility	Close or divest	Retain	Insufficient alternative capacity
Joint Preflight Integration of Munitions Systems Facility	Close or divest	Consider divesting to Army if flight testing moves	Low cost Should be collocated with range
McKinley Climatic Laboratory	Mothball	Retain	Unique capability High usage Low cost
Seeker-Signature T&E Facility	Close or divest	Retain	Low cost
Benefield Anechoic Facility	Reduce	Restore if J-PRIMES divested and/or to retain network-centric test capability	Sole Air Force full-size anechoic chamber if J-PRIMES divested
National Full-Scale Aerodynamic Complex	Close or divest	Consider divesting to Army	Not related to core Air Force mission (policy decision)

study, the details were not fully refined. Similarly, this effort would require a thorough examination of the types of personnel required, as well as the selection of best practices for testing programs and maintaining and flying aircraft. With respect to the OAR, the Air Force would need to work closely with the Navy to ensure an equitable allocation of time on the range schedules at NAWC Point Mugu and NAWC China Lake. Although Air Force personnel at Edwards AFB routinely work with Navy colleagues to coordinate airspace and range activities in the WTR, the amount of OAR flight-test activities that the AFMC proposal would transfer would require a purposeful approach to ensure that the test activities can be accomplished.

As the Air Force looks to the future, there is a broader concern about the risk the service may incur by divesting itself of T&E infrastructure. If facilities or ranges are divested, the Air Force would be eliminating its capability to conduct future developmental testing at various locations. This in turn could lead to one of two possible outcomes:

1. greater reliance on contractors in the longer term for developmental testing, which could possibly offset savings from divestiture or consolidation
2. fewer tests, which could increase a program's risks over its life cycle.

One of T&E's current priorities is to find ways to do better and more-realistic developmental testing earlier to avoid problems later. It is possible that consolidation or divestiture could move the Air Force in the opposite direction, with more reliance on contractors and less-insightful developmental testing overall.

Limitations of This Analysis

As a significant caveat to our work, the results presented in this monograph are driven primarily by cost considerations. We do not attempt to quantify the value of benefits that would be lost in the future if the Air Force required the use of the affected ranges or facilities. For example, the Air Force might require more testing in the future at a specific facility or range. If that capacity were already in maximum use or no longer existed, the effects on programs and their ability to test would be negative.

We could not objectively quantify the potential for future operational surges or other associated benefits, such as increased capacity, that are available to the Air Force today. RAND's findings about cost are driven primarily by data and estimates from the Air Force and from other government sources that we contacted and interviewed for this work. In many cases, we were not able to assess the quality of the cost and savings estimates provided to us. As previously stated, we used a series of repetitive inquiries to stakeholders and compared data sources and interviews to develop a more-complete picture for the analysis.

Because of the general uncertainty of the details in parts of the AFMC proposal, it was not uncommon for the test organizations to provide updated inputs to us as further consideration matured their thinking about possible consequences. We expect that, with more time and further study of this subject, the test enterprise will be able to continue to refine data collection and analysis.

All the data that was collected and presented in this analysis are unclassified. The AFMC proposal, as stated, addressed programs that were considered to be unclassified. We did not include consequences for classified programs or for facilities that address classified T&E activi-

ties. Consideration of how these programs would be affected would likely indicate that the Air Force will face higher costs and risks if the AFMC proposal were implemented.

Finally, we emphasize that not all the cost savings identified in the analysis should be interpreted as being available to meet the $371 million budget decrement that PBD-720 imposes on AFMC T&E over the FYDP. In some cases, the savings are in fact available to be taken without imposing burdens elsewhere in the DoD budget. In other cases, however, the AFMC proposal may allow the AFMC T&E to meet its savings goal by shifting the burden elsewhere in the Air Force or DoD.

Conclusions

In sum, analysis shows that the FYDP savings support consolidation of the 46th and 412th Test Wings discussed earlier. The wing consolidation would involve a substantial amount of effort, and more-detailed planning would be needed to ensure that all parties involved understood the plan and the sequence of events. The effects on the Eglin range are mixed. The demand for use of the ground-test ranges and the consequences for customers if the ranges are closed indicates that the ranges should remain open or be transferred to other services. The analysis of OAR flight testing shows potential savings over the FYDP, but transferring the flight-test activities would require considerable coordination between the Air Force and the Navy and could affect a myriad of other users. It is important to note that the consolidation of the 46th Test Wing and the OAR must be linked—that is, one cannot be done without the other. Analysis of the facilities shows a continuing need for them but not in all cases a need for the Air Force to control them.

The financial savings associated with both the consolidation and the transfer of the open-air flight testing from Eglin to the WTR must be tempered according to the type and amount of risk that the Air Force is willing to accept from the AFMC proposal. These risks are not trivial and include potential schedule delays for program testing, increased customer costs, and decreased T&E capacity. When possible, we have examined how the plan would affect customers but were limited by time and an inability to verify all potential consequences for customers. Many of these risks require further study and could not be definitively captured within the constraints of this analysis.

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We thank the U.S. Air Force for the opportunity to contribute to this important topic as it considers the effectiveness and efficiency of managing T&E across the institution. This monograph could not have been completed without the assistance of many people within the Air Force and across DoD. Their tireless commitment to answering our requests for data, interviews, and site visits was paramount to the successful completion of this CBA. Without their support, we could not have compiled or analyzed the significant amounts of data provided within the time frame set forth by Congress. We are indebted to the people of the Air Force, Navy, Army, and the Office of the Secretary of Defense T&E enterprise—their professionalism and commitment to T&E were apparent throughout our conversations and research. We are also thankful for the time and interest of the congressional staff members who were engaged throughout this process and helped us ensure that the scope of the project was appropriate. The authors also thank the sponsors and reviewers for their thoughtful comments on the various drafts and the briefing material that has been presented to date. Any errors or omissions are the sole responsibility of the authors.

Abbreviations

AAC	Air Armament Center
ABSTIRRS	Airborne Staring Infrared Radiometric System
ACC	Air Combat Command
ACETEF	Air Combat Environment Test and Evaluation Facility
ACM	Advanced Cruise Missile
AEDC	Arnold Engineering Development Center
AFB	Air Force base
AFEWES	Air Force Electronic Warfare Evaluation Simulator
AFFTC	Air Force Flight Test Center
AFI	Air Force Instruction
AFMC	Air Force Materiel Command
AFOTEC	Air Force Operational Test and Evaluation Center
AFSEO	Air Force Seek Eagle Office
AFSOC	Air Force Special Operations Command
AGE	aerospace ground equipment
AGRI	Air-to-Ground Radar Imaging
AIM	air intercept missile
ALCM	Air-Launched Cruise Missile
AMIRS	Advanced Millimeter Wave Imaging Radar System
AMRAAM	Advanced Medium-Range Air-to-Air Missile
ARAT	Army Reprogramming Analysis Team
ARTM	Advanced Range Telemetry
ASIMS	Airborne Spectral Infrared Measurement System

ATEF	Aeroballistics Test and Evaluation Facility
BAE	BAE Systems Inc.
BAF	Benefield Anechoic Facility
BISS	Base Installation Security Systems
BOS	base operating support
BRAC	Base Realignment and Closure
BRU-57	Bomb Rack Unit 57
C4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CBA	cost-benefit analysis
CIGARS	Calibrated Infrared Ground and Airborne Radiometric System
CIGTF	Central Inertial and Guidance Test Facility
CME	contract manpower equivalent
CPM	continuous phase modulation
CSAR	combat search and rescue
CTF	combined test force
DARPA	Defense Advanced Research Projects Agency
DBA	direct budget authority
DEWSIM	Directed Energy Weapon Simulator
DHS	Department of Homeland Security
DJC2	Deployable Joint Command and Control
DoD	Department of Defense
DU	depleted uranium
EEE	electromagnetic environmental effects
EGI	embedded Global Positioning System and inertial systems
EMMLS	Eglin Mobile Missile Launcher System
EMPIRS	Eglin Multi-Platform Imaging Radiometric System
EO	electro-optical
ESC	Electronic Systems Command
EW	electronic warfare
EWG	electronic warfare group

FAA	Federal Aviation Administration
FGT	functional ground test
FHP	flying hour program
FM	frequency modulation
FQPSK	Feuer QPSK
FY	fiscal year
FYDP	Future Years Defense Program
GBTF	Gunnery and Ballistics Test Facilities
GPS	Global Positioning System
GWEF	Guided Weapons Evaluation Facility
HITL	hardware-in-the-loop
HPO	high performance organization
HTF	HELLFIRE Test Facility
I&M	improvement and modernization
IBAR	Integrated Battlespace Arena
IR	infrared
JASSM	Joint Air-to-Surface Standoff Missile
JDAM	Joint Direct Attack Munition
J-PRIMES	Joint Preflight Integration of Munitions and Electronic Systems
JSOW	Joint Standoff Weapon
KEMTF	Kinetic Energy Munitions Test Facility
LASI	Large Aircraft Survivability Initiative
LRTA	Large Rotor Test Apparatus
MALD	Miniature Air-Launched Decoy
MANPADS	man-portable air defense system
MCL	McKinley Climatic Laboratory
MERAJS	Millimeter Wave Emitters, Radars, and Jamming System
MMS	Millimeter Wave Materials Measurement System
MMW	millimeter wave
MOS	military occupational specialty

MROCS-2	Millimeter Wave Obscurant Characterization System
MRTFB	Major Range and Test Facility Base
MSCF	Master Surveillance and Control Facility
MSIC	Missile and Space Intelligence Center
MSTTE	Multi-Spectral Test and Training Environment
MXG	maintenance group
MXS	maintenance squadron
NAS	naval air station
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NAVAIR	Naval Air Systems Command
NAWC	naval air warfare center
NAWCWD	Naval Air Warfare Center Weapons Division
NDAA	National Defense Authorization Act
NFAC	National Full-Scale Aerodynamic Complex
NGIC	National Ground Intelligence Center
NPV	net present value
OAR	open-air range
OFP	operational flight program
OG	operations group
OGT	operational ground test
OMB	Office of Management and Budget
OPM	Office of Personnel Management
OSD	Office of the Secretary of Defense
OSS	operations support squadron
OUSD/AT&L	Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics
PAA	primary aircraft authorization
PAF	Project AIR FORCE
PBD-720	Program Budget Decision 720
PCM	pulse code modulation

PCS	permanent change of station
PSSSEF	Portable Seeker/Sensor/Signature Evaluation Facility
QPSK	quadrature phase shift keying
RBA	reimbursable budget authority
RIF	reduction in force
REU	resource earning unit
RF	radio frequency
RTTC	Redstone Technical Test Center
SAF/AQ	Office of the Assistant Secretary of the Air Force for Acquisition
SAR	synthetic aperture radar
SARIS	Spatial and Spectral Airborne Radiometric Infrared System
SDB	Small Diameter Bomb
SDBII	Small Diameter Bomb Increment II
SFW	sensor fuzed weapon
SFW-IR	sensor fuzed weapon, infrared
SMTA	Static Munitions Test Arenas
SOQPSK-TG	shaped quadrature phase shift keying–telemetry group
SRC	Sea Range Complex
STEF	Seeker/Signature Test and Evaluation Facility
STEM	Simulated Test Environment for Munitions
STIRRS	Staring IR Radiometric System
T&E	test and evaluation
THAAD	theater high-altitude area defense
TM	telemetry
TPS	Test Pilot School
TRMC	Test Resource Management Center
TSA	Transportation Security Administration
TW/OG	test wing operations group
USAFWC	U.S. Air Force Warfare Center
WCMD	Wind-Corrected Munitions Dispenser

WCMD-ER	Wind-Corrected Munitions Dispenser–Extended Range
WTR	western test ranges

CHAPTER ONE

Introduction

Background

The Air Force fleet is aging, with many aircraft older than the pilots who fly them. However, recapitalizing the fleet is expensive, and, given the many operational demands on the Air Force, additions to the budget for this purpose are unlikely. Thus, the Air Force has looked inside its own budget for savings that it could apply to recapitalizing the fleet. In 2006, the Office of the Secretary of Defense (OSD) issued Program Budget Decision 720 (PBD-720), which, among other things, directed a $6.2 billion reduction over fiscal years (FYs) 2007 through 2011. A significant portion of this amount was to be gained by reducing contractor support. Air Force Materiel Command's (AFMC's) share of this reduction totaled $839 million, of which $371 million was test and evaluation's (T&E's) share. To meet the $371 million budget objective, AFMC examined several options with varying effects on the T&E infrastructure. One of these options, referred to as the "Organizational Streamline Approach," focused on the consolidation and potential divestiture of U.S. Air Force T&E facilities and capabilities. This option was originally submitted to OSD as part of the Budget Estimate Solution for FY 2008.

Generally, the option proposed a combination of consolidation, divestiture, and reductions in T&E facilities. More specifically, it proposed the following:

- consolidation of the 46th Test Wing at Eglin Air Force Base (AFB), Florida, with test organizations at Edwards AFB, California, primarily the 412th Test Wing[1]
- full or partial divestiture of seven Air Force test facilities:
  - McKinley Climatic Laboratory (MCL, Eglin AFB)
  - Guided Weapons Evaluation Facility (GWEF, Eglin AFB)
  - Seeker/Signature Test and Evaluation Facility (STEF, Eglin AFB)
  - Joint Preflight Integration of Munitions and Electronic Systems (J-PRIMES, Eglin AFB)
  - Central Inertial Guidance Test Facility (CIGTF, Holloman AFB, New Mexico)

[1] Test personnel supporting command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); the Air Force Special Operations Command (AFSOC); and the Air Force Seek Eagle Office (AFSEO) were expected to remain in place at Eglin AFB.

  - National Full-Scale Aerodynamics Complex (NFAC, Moffett Field, California)
  - Benefield Anechoic Facility (BAF, Edwards AFB) (partial)[2]
- a reduction in T&E Range capacity at Eglin AFB.[3]

In the 2007 Defense Appropriations Act, Congress responded to the AFMC proposal by directing the Air Force to study the potential effects of this option.[4] Section 8110(a) of the 2007 Defense Appropriations Act directed:

> the Secretary of the Air Force shall, not later than March 31, 2007, submit to the congressional defense committees a cost-benefit analysis of significant proposed realignments or closures of research and development or test and evaluation installations, activities, facilities, laboratories, units, functions, or capabilities of the Air Force. The analysis shall include an evaluation of missions served and alternatives considered and of the benefits, costs, risks, and other considerations associated with each such proposed realignment or closure.

In November 2006, the Air Force contacted RAND Project AIR FORCE to conduct the CBA. Discussions in late November 2006 and early December 2006 focused on understanding the intent of the appropriations requirement, concluding that it meant an analysis of the "Organizational Streamline Approach" option that was presented in the AFMC PBD-720 proposal.

Project Scope

Given that we had approximately three months to complete this work, it was important to ensure that we were addressing the correct policy question(s) that were underlying the appropriations act. The boundaries of this work were purposefully limited to the AFMC proposal articulated above. We did not propose ideas that we deemed to be more efficient or more effective than the alternatives presented to us for analysis. This was consistent with the direction that we received throughout the project from congressional staff and in discussions with personnel from the Air Force and TRMC. Specifically stated, we were asked to assess, in terms of the spirit and intent of the language in the appropriations act, the specific set of proposals and the alternatives that AFMC had articulated. As we dug deeper into understanding the AFMC proposal, we realized that it was driven by budget cuts to meet PBD-720 objectives and that

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[2] An anechoic chamber is a room in which there are no echoes. This description was originally used in the context of acoustic (sound) echoes caused by reflections from the internal surfaces of a room, but the same description has more recently been adopted for the radio frequency (RF) anechoic chamber.

[3] Air Force organizations that were asked to implement this proposal inferred that this also meant preserving some ability to support deployed flight testing, if necessary. This assumption was the foundation on which Eglin AFB provided data to RAND for this analysis.

[4] The 2007 Defense Authorization Act language also included this subject, but the Air Force is addressing that language through other means. The FY 2007 authorization language (Items of Special Interest, p. 633) also requires several reports, one from the Secretary of the Air Force and the other jointly from the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD/AT&L) and the Director of the Test Resource Management Center (TRMC) "analyzing the proposed actions." No specific deliverable date is associated with these reports. Although the RAND Corporation's cost-benefit analysis (CBA) specifically addresses the appropriations language, Air Force T&E, AFMC, and RAND have agreed that information from the CBA document will also be helpful to the Air Force in answering the authorization language.

the Air Force had completed limited transition planning by the time that we were engaged in November 2006.

The latter point was especially important for defining the analytical scope of the CBA. Within days of starting this work, it was clear to us that the Air Force did not have finalized, detailed plans for how the divestiture and consolidation of T&E infrastructure would occur. In some cases, there were limited plans; for example, the original AFMC proposal listed alternatives to simply closing the seven facilities listed earlier. In other cases, such as the consolidation of the 46th and 412th Test Wings or transfer of range activities, there was limited documentation that specified all the cost effects and activities that would need to occur to ensure a proper transfer of people, assets, and activities.

Because of the limited documentation and our commitment to directly addressing the purpose for the appropriations act language, we were careful not to create new alternatives to the AFMC proposal that had not already been stated; rather, we attempted to analyze the plans that were in place as of November 2006, when we began this work. The only addition to the AFMC proposal that RAND considered was whether Edwards AFB and the Navy installations at Naval Air Warfare Center (NAWC) Point Mugu and NAWC China Lake could accommodate the flight- and ground-test workload from Eglin AFB. Although the AFMC proposal did not specify explicitly, it did imply that, if the PBD-720 cuts significantly affected the Eglin range, the Air Force would need to conduct these activities elsewhere (e.g., Edwards AFB and the Navy range and facilities). To arrive at a better understanding of what open-air range (OAR) flight-test activities could be conducted on the western test ranges (WTR), personnel from Eglin AFB, Edwards AFB, NAWC China Lake, and NAWC Point Mugu met to discuss the capabilities of the organizations. This group completed documentation of this exercise in February 2007, which became an important assessment resource for our CBA.

Research Approach

In conducting this research, RAND used several methods to collect and analyze data.

Data Sources

During the course of the three months over which we conducted this work, we interviewed more than 200 people from across the Department of Defense (DoD) T&E infrastructure, collected data on the part of that infrastructure directly related to the AFMC proposal, and conducted literature searches to gather insight from previous studies. The bulk of personnel interviewed for this work were located at the bases and facilities that were directly affected by the AFMC proposal: Eglin AFB, Florida; Edwards AFB, California; Moffett Field, California; Holloman AFB, New Mexico; and Arnold AFB, Tennessee. We also interviewed people outside the Air Force, including some from the Army and the Navy. In the latter case, RAND facilitated the dialogue between the Air Force and the Navy to develop an understanding of the technical and cost consequences for flight- and ground-test operations at NAWC Point Mugu and NAWC China Lake.

Throughout the project, RAND actively engaged stakeholders across DoD to ensure that the data collected for the project represented the most accurate information available. Hundreds of contacts were made, via telephone calls, emails, site visits, and video teleconferences, to ensure that we had the very best data to consider for this work. We not only coordinated our

data collection in real time with the many stakeholders involved but also shared data with colleagues within OSD who were working a similar research effort in parallel, as required by the National Defense Authorization Act (NDAA) for FY 2007.[5] In many cases, test organizations provided updated inputs up to the final stages of preparing this document.

A key objective of this research process was to ensure that all the stakeholders were aware of the data that we were collecting—the data were openly shared with personnel from the Air Force, Navy, Army, and OSD to ensure that all were using the same data for their analyses and as the basis of their conclusions. Finally, we met with congressional staffs several times to keep them abreast of our research approach and methodology and to ensure that they were in agreement with the scope of our work. All the data collected and presented in this analysis is unclassified.[6]

Effects on Customers

We also considered what the effects on customers of the T&E facilities and ranges that were analyzed in the AFMC proposal would be. The Air Armament Center (AAC), in conjunction with the Office of the Assistant Secretary of the Air Force for Acquisition (SAF/AQ), collected data from customers of the 46th Test Wing facilities and range at Eglin AFB, Florida, and at Holloman AFB, New Mexico. The data included customers from the Air Force, DoD, and U.S. government–sponsored programs.

It is our understanding that customers were asked for assessments of the additional costs they might incur during the FY 2008–2013 time frame because of the AFMC proposal. The types and amounts of cost and schedule effects were left open to the interpretation of the customers that responded to the survey. This information was aggregated and provided to RAND in late December 2006 in the form of a slide presentation. Our immediate review of the presentation indicated that backup detail on how the costs were generated was very limited. At face value, the AAC presentation showed considerable consequences for customers—on the order of $673.7 million over the FY 2008–2013 time frame, which is two years beyond the Future Years Defense Program (FYDP) for FYs 2007–2011 that AFMC proposed. Of this figure, $359.1 million was allocated to customers that tested in facilities; the remaining $314.6 million was allocated to customers that tested on the range or with the aircraft of the 46th Test Wing.

To understand how these costs were developed, we worked with staff at AAC and Eglin AFB to review the customer inputs. AAC staff provided us with emails and other inputs from customers that listed cost figures. In many cases, the data provided to AAC were not substantiated by rigorous cost-estimating methods or detailed background information that we could decipher and readily adjudicate. In our assessment, this limited our ability to include the entirety of the data in the CBA.

Although we were able to use some of the customer cost data in our CBA—our calculations in Chapters Two through Four include these data when we could verify their integrity—we also found cases in which the quality of the data was suspect. In some instances, the data in

[5] The NDAA requires two additional reports that are similar in intent to this one: (1) a report by the Test Research Management Council and (2) a report jointly authored by the Air Force and the Office of the Secretary of Defense.

[6] This important consideration should not be overlooked. The AFMC proposal, as stated, addressed programs that were considered to be unclassified. We did not include the consequences for classified programs or to facilities that addressed classified T&E activities.

the AAC presentation could not be substantiated by the same organizations that had provided information during the original survey. In other cases, there was significant uncertainty about the validity of data: (1) Some customers appear to have assumed worst-case cost scenarios that required an entire rebuild of capital infrastructure (when other, more cost-effective solutions may have been available), and/or (2) customers projected large costs in the FY 2012–2013 time frame, beyond the FYDP of the AFMC proposal. In the latter instance, we question the inability of a customer to readjust its scheduling to another facility or range if it were given five to six years (starting in 2007) to do so. In other cases, we had already included data in our analysis (effects on the 53rd Wing at Eglin) that the AAC analysis captured as a "customer cost." In the remainder of this monograph, we refer to the AAC data when we were or were not able to verify usage. Given the schedule constraints of this project, our ability to validate every program schedule and cost that the AFMC proposal affected was limited. We openly state this as a limitation in the analysis.

How We Analyzed the Data

After collecting relevant data for the study, we constructed financial analyses that captured the economic benefits and costs of the proposal. One key assumption of our work was that the demand for test-program content would remain constant. This meant that customers of Air Force T&E who were affected by the AFMC proposal would still have a requirement to test—and to do so, they would have to gain some capability to achieve their objectives. This assumption ensured that we addressed relevant collateral effects. When possible, we attempted to quantify the effect on the customers by analyzing what it would cost the programs to do the testing themselves and how schedule concerns would affect their T&E approach. As we collected and analyzed this information, we discovered that some effects were quantifiable and verifiable and that others were not. In both cases, we determined that implementing the AFMC proposal also held risks for the customers and for the organizations involved. In this monograph, we address the customer-related issues and discuss how we did or did not use the information we received. Comparing and contrasting the results of the economic analysis with the qualitative findings helped us draw conclusions.

Although we attempted to quantify T&E issues as much as possible, we were unable to do so in several cases. In these, we qualitatively assessed the potential for benefit or cost. This required us to compare all data sources and to fact-check information continuously through inquiries and discussions with subject-matter experts within the organizations. Because of the general uncertainty of the details of parts of the AFMC proposal, it was not uncommon for the test organizations to iterate on their inputs to us as they further considered and matured their thinking on possible consequences. We expect that, with more time and further study of this subject, the test enterprise will continue to refine data collection and analysis.

Financial Methods and Considerations

In conducting our financial calculations, we considered financial effects over FYs 2007 through 2011, to be consistent with the FYDP time frame that AFMC proposed. As discussed later in the monograph, we examined the effects on facilities, ranges, and organizations over this time frame, while also including potential recurring impacts in FY 2012 and beyond. We also performed net present value (NPV) analysis on the AFMC proposal to ensure that we were

accounting for longer-term effects that went beyond the FYDP.[7] This information is presented in Appendixes B, C, and D.

As a significant caveat to our work, the results presented here are driven primarily by cost considerations and do not attempt to quantify the value of benefits that would be lost in the future if the Air Force required the use of the affected ranges or facilities. For example, it is possible that the Air Force could require more testing in the future at a specific facility or range. If that capacity was already in maximum use or no longer existed, the effects on programs and their ability to test would be negative. We did not consider the potential for future operational surge or other associated benefits, such as increased capacity, that are available to the Air Force today. RAND's findings about cost are driven primarily by data and estimates from the Air Force and other government sources that we contacted and interviewed for this work. In many cases, we were not able to assess the quality of inputs into the cost estimates and savings estimates provided to us. A series of repetitive inquiries to stakeholders helped us make comparisons among data sources, and interviews helped us develop a more-complete picture of the analysis.

Finally, we emphasize that the cost savings identified in the analysis should not be interpreted as being available to meet the $371 million budget decrement that PBD-720 imposes on AFMC T&E over the FYDP. In some cases, the savings are in fact available to be taken without imposing burdens elsewhere in the DoD budget. In other cases, however, the AFMC proposal may allow the AFMC T&E to meet its savings goal by shifting the burden of the wedge elsewhere in the Air Force or DoD.

Organization of This Monograph

In Chapter Two, we discuss the effects of consolidating the 46th Test Wing from Eglin AFB and the 412th Test Wing at Edwards AFB. This analysis addresses not only how the transition would affect the 46th Test Wing's test aircraft but also how the transition would affect the 46th Test Wing's supportability, Edwards AFB and its ability to absorb 46th Test Wing aircraft and personnel, and the 53rd Wing's supportability at Eglin AFB. Chapter Three addresses the effects on the Eglin test range—both flying, open-air activities and ground-range activities that would be affected by the amount of support contractor cuts that would be necessary under the AFMC proposal. Chapter Four covers the effects on the seven facilities that were proposed for divestiture or partial closure.[8] In conducting this analysis, RAND visited all the proposed facilities, interviewed key staff members, and analyzed facility and customer cost and schedule data. Chapter Five presents a summary of key findings and recommendations.

There are also four appendixes: Appendix A summarizes the Flight Test Consolidation Scheduling Exercise that was conducted in February 2007. Appendixes B through D detail the financial calculations for our analyses in Chapters Two through Four, respectively.

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[7] NPV analysis is a standard approach used in DoD and non-DoD financial analyses used to examine capital budgeting decisions. By definition, it accounts for the time value of money by discounting future cash flows to the present time frame to compare net effect of aggregating the cash flows.

[8] The Benefield Anechoic Chamber is the sole candidate for partial closure.

CHAPTER TWO

Test Wing Consolidation

This chapter describes the effects of the proposed consolidation of the 46th Test Wing, currently at Eglin AFB, with the 412th Test Wing at Edwards AFB. It begins with a brief description of the two test wings, then moves to a brief discussion of some of the personnel issues that would attend the proposed transfer. It next discusses the assets that would move to Edwards AFB and describes the effect of these moves. That discussion is followed by one about support staff reductions, and, finally, how the movement of the 46th Test Wing would affect the 53rd Wing, which would remain at Eglin and which currently shares resources with the 46th Test Wing.

The Test Wings

Overview: The Air Armament Center and the 46th Test Wing

The AAC at Eglin AFB comprises the 46th Test Wing, 96th Air Base Wing, 328th Armament Systems Wing, 308th Armament Systems Wing, and 329th Armament Systems Group.

The 46th Test Wing, as part of the AAC, is the test organization responsible for AAC weapon and range system acquisition programs; Electronic Systems Center command, control, communications, computers, and intelligence (C4I) system acquisition programs; and Air Force Special Operations Command systems acquisition programs. The wing also serves as the steward of the Major Range and Test Facility Base (MRTFB) located at Eglin AFB, Florida, which provides a national capability for T&E of defense weapons. The Eglin MRTFB military complex comprises more than 134,000 mi^2 of airspace and 724 mi^2 of land ranges. The wing offers a scientific test process that supports the development and enhancement of munitions systems that support triservice smart-weapon development. It also has the correct technology for testing such weapon systems as the Advanced Medium-Range Air-to-Air Missile (AMRAAM), Joint Direct Attack Munitions (JDAM), Small Diameter Bomb (SDB), Combat Search and Rescue X (CSAR-X), Advanced Short-Range Air-to-Air Missile, Joint Tactical Information Distribution System, Joint Surveillance Target Radar System, and Combat Talon. The 46th Test Wing controls test aircraft, test facilities, and land and water test ranges at Eglin and additional test facilities at Holloman AFB, New Mexico; Nellis AFB, Nevada; Kelly AFB, Texas; and Wright-Patterson AFB, Ohio.

Edwards AFB Overview

Edwards AFB, California, covers 301,000 acres (roughly 470 mi^2) and is the second largest Air Force base. It boasts the country's longest runway, measured in miles rather than feet. Edwards

is located in the Mojave Desert, adjacent to the largest dry lakebed in North America—Rogers Dry Lake, whose clay surface measures roughly 12 by 5 mi.

The base has 19 runways—three are paved, and the other 16 are located on the lakebed. The longest paved runway is 15,000 ft long, 300 ft wide, and 3 ft thick. The longest of the lakebed runways is 7.5 mi long. Because of the forgiving length and width, this vast array of landing surfaces can be a huge benefit for the safe recovery of test aircraft or for aircraft landing with in-flight emergencies.

The Air Force Flight Test Center (AFFTC) at Edwards AFB provides DoD-wide support for weapon-system development and operational T&E for aircraft, aircraft subsystems and weapon systems, aerospace research vehicles, unmanned miniature vehicles, cruise missiles, parachute delivery and recovery systems, cargo-handling systems, communications, information operations, and electronic warfare (EW) systems.

The EW test process provides a scientific methodology for the effective and efficient test of EW and avionics systems. Testing is conducted on EW systems that can be used in any military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. Related operations are conducted using the Air Force Electronic Warfare Evaluation Simulator (AFEWES) at Air Force Plant 4 in Ft. Worth, Texas. The Edwards AFB mission includes the U.S. Air Force Test Pilot School (TPS).[1]

Human Capital Issues

The majority of the savings from the AFMC consolidation plan would accrue either from closing facilities entirely or from transferring a function from one location (Eglin AFB) to another (Edwards AFB) and operating more efficiently there. These actions primarily redistribute the workforce, reducing the number of contractor support personnel at Eglin,[2] recharacterizing positions in the new location, and filling positions at Edwards with either civilian or military personnel.

Civilian and military personnel would be redistributed within the existing workforce to cover the reduction of the contractor workforce specified in PBD-720. The military workforce is mobile. The military workforce undertakes assignment changes and permanent changes of station (PCSs) regularly. However, convincing a civilian worker to move from Ft. Walton Beach, Florida, to the high desert of Palmdale, California, would be a formidable challenge. For the purposes of this analysis, we used a Base Realignment and Closure (BRAC)–accepted PCS rate for civilians of 20 percent.

It may take more than several years to reconstitute the Eglin civilian workforce at Edwards AFB. Doing so successfully, by achieving manning levels consistent with the intended outcome of this plan, would require aggressive recruitment, nationwide searches for new hires, and the associated expenses. Hiring this new workforce is likely to lead to such additional costs as instituting incentive bonus programs, long-term training programs, college tuition incentives, and other programs necessary to attract a new civilian workforce to Edwards. For the purposes of this CBA, we not only have assumed a 20-percent PCS rate but also take 50 percent of the annual civilian pay rate for expenses associated with incentives, recruitment, and training for each new civilian that would be hired for the new combined test wing.

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[1] Headquarters, U.S. Air Force, 2007.

[2] For accounting purposes, these support personnel are often referred to as contract manpower equivalents (CMEs).

Summary of Findings

The rest of this chapter discusses specific effects of the test wing consolidation. Table 2.1 summarizes our findings, and each area listed is discussed in greater detail within this chapter.

What Functions Would Move from the 46th Test Wing to Edwards AFB?

AFMC's plan proposes to combine the 46th Test Wing flying hour program (FHP), maintenance functions, and support staff with the 412th Test Wing at Edwards AFB. Our analysis explores each activity, describes the baseline funding and manpower levels of the AFMC plan, projects alternative plans as appropriate, and discusses the associated manpower and funding effects of moving each.

Table 2.1
Summary Chart—Unified Set of Cost Accounts ($M)

	Annual Savings	Annual Costs	Total Annual Savings	Nonrecurring Costs	Cost Savings Over FY 2007–2011 FYDP
Total for all 46th Test Wing consolidation[a]	71.7	30.4	41.3	58.3	43.2
53rd Wing total[a]	0.0	30.4	(30.4)	0.0	(91.2)
53rd operations support[b]	0.0	3.5	(3.5)	0.0	(10.5)
53rd maintenance					
53rd flightline[b]	0.0	15.6	(15.6)	0.0	(46.5)
53rd backshop[b]	0.0	11.3	(11.3)	0.0	(33.9)
Combined 46th and 412th flightline maintenance[c]	27.5	0.0	27.5	8.6	53.4
Combined 46th and 412th backshop maintenance[d]	3.8	0.0	3.8	40.1	(28.6)
Flying hour program[e]	3.1	0.0	3.1	0.0	7.3
Support staff[f]	37.3	0.0	37.3	9.6	102.3

[a] These totals include flightline scenario 2 and backshop scenario 1, as discussed in the maintenance section.

[b] See Table B.12 for supporting information. Not included in AFMC plan.

[c] See Table B.11 for supporting information. AFMC's planned reductions are not used in the RAND analysis and are explained further elsewhere in this chapter. Two scenarios for cost reductions are provided in the text. The first maintains the current ratio of maintainers to aircraft using AFMC's direction to excess three F-16 aircraft as a result of consolidation.

[d] See Table B.8 for supporting information. AFMC's planned reductions are not used in the RAND analysis and are explained further elsewhere in this chapter. The current ratio of maintainers to aircraft is retained as workload is consolidated, using AFMC's direction to excess three F-16 aircraft. Nonrecurring costs include civilian recruitment, reduction to contractor workforce, support equipment moving costs, and military construction.

[e] See Table 2.2 for supporting information. The RAND analysis partially rejects the AFMC plan, as explained further elsewhere in this chapter. The savings generated are less than AFMC and driven by the AFMC plan to reduce three F-16 aircraft.

[f] See Table B.5 for supporting information. The RAND analysis partially rejects the AFMC plan, as explained further elsewhere in this chapter. AFMC's savings appear to be overstated. RAND calculations are based on a 30-percent reduction of support staff as a combined operation, as opposed to AFMC's 40-percent reduction.

46th Flying Hour Program

The AFMC plan combines the two test fleets of the 46th and 412th Test Wings at Edwards AFB.[3] This involves moving not only the 46th Test Wing FHP but also all the associated maintenance functions, as we will discuss later. Maintenance is discussed later in this chapter. The 46th Test Wing FHP includes the following primary aircraft authorization (PAA)[4]:

- Seven F-15s. Three F-15 A-Ds are fully instrumented for all development of F-15 testing, including operational flight program (OFP) and software suites. These aircraft support all combat air force and foreign military air-to-air missile development, internal countermeasure system software and hardware upgrade testing and development, and improvement programs for APG-63, APG-63(V)1, and APG-70 radar systems and operational flight programs. The remaining four F-15Es are considered highly modified, one-of-a-kind test articles. These aircraft support development of all conventional U.S. Air Force and some foreign weapons, air-to-air and air-to-ground, including Joint Air-to-Surface Standoff Missile (JASSM), Joint Standoff Weapon (JSOW), JDAM, SDB, Wind-Corrected Munitions Dispenser (WCMD), Wind-Corrected Munitions Dispenser–Extended Range (WCMD-ER), AMRAAM, and Air Intercept Missile 9-X (AIM-9X), and countermeasures, including chaff, flare, and towed decoys, and support the development and testing of APG-70 radar and Pratt-Whitney F-100-229 and F-100-220 engines. They also provide high-speed and supersonic chase to capture photographic evidence of safe separation of weapons.
- Ten F-16s. Seven of these F-16s are highly modified, one-of-a-kind test aircraft, while the other three provide supersonic chase support for photographic documentation of weapon separation events. The F-16s support testing for Seek Eagle, JASSM, JDAM, Sensor-Fuzed Weapon (SFW), WCMD, WCMD-ER, JSOW, BRU-57, AMRAAM, AIM-9X, Operational Flight Program integration and verification, foreign military sales, and commercial programs.
- Two A-10C aircraft. Only two of these are in the AFMC inventory; they are equipped with over $4 million of specialized modifications for supporting numerous avionics and munitions testing and development programs. The prototype C aircraft accomplish validation and verification for the entire Air Force fleet upgrade (to "C"). These aircraft specifically support testing related to weapon and avionics integration and reliability and maintainability upgrades, as well as major upgrades, such as Suite 3 Precision Engagement. The aircraft also support gunfire evaluations and anomaly resolution with the GAU-8 30-mm internal gun, as well as conventional-weapon development programs.

The following aircraft are currently assigned to the 46th Test Wing but will remain at Eglin AFB even if the wing relocates:

- Two UN-1N helicopters. These two aircraft provide flight-test program and AAC range-resource support. These aircraft specifically support JASSM, Rotor Swash Plate verifica-

[3] The FHP discussed here does not include the 46th Test Group located at Holloman AFB. Although the operational control of the 46th Test Group will transfer to Edwards AFB under this plan, no aircraft will be moved from Holloman to Edwards.

[4] PAA is the number of aircraft authorized to a unit to carry out its mission.

tion, aircraft performance validation and verification, onboard oxygen-generating system and night-vision goggle performance testing, flight testing of unique attack profiles for precision attack seeker development, and airdrop testing of unique sensors. They also retrieve targets and cruise missiles terminated in the Gulf.

- One C-130. The primary mission of this uniquely equipped, dedicated AFMC test-bed aircraft is Airborne Seeker Evaluations and Test System testing. The aircraft also supports Advanced Tactical Advanced Concept Technology Demonstration and other airborne directed-energy testing.

Effect of Moving FHP to Edwards AFB. The primary issue with consolidating the two aircraft fleets is whether all the 46th Test Wing's aircraft will be necessary when collocated with the 412th Test Wing. AFMC's annual T&E Fleet Board Minutes, dated June 6, 2006, specifically state:

> F-16 Fleet Reduction (Approved)—The AFMC Plan for implementing PBD-720 contract reduction achieves efficiencies though fleet consolidation. These efficiencies require a reduction to the F-16 fleet by 1 aircraft in FY09 and 2 additional aircrafts in FY10. The fleet board approved these reductions. The reductions approved above cannot be achieved without consolidation which is planned to occur in FY09.[5]

As a result of this decision, the AFMC plan reduces the combined aircraft fleet by three aircraft. Because no changes were planned for the F-15 or the A-10, the remainder of this subsection will deal only with the F-16 fleet.[6]

Findings. Our approach was to determine the savings that would result from the AFMC plan to excess three aircraft. The following assumptions are part of this analysis:

1. Crew ratios (number of pilots per aircraft) would remain constant.
2. The current number of test hours would remain constant.
3. Pilot levels would include attached and assigned pilots. We assume the same ratio of proficiency to test and test support for assigned and attached pilots.[7]
4. Since the AFMC plan implements this change across two years (one excess F-16 in FY 2009, two in FY 2010), we will, for simplicity, calculate annual savings for the entire three aircraft reduction and include one-third of this total savings in FY 2009 and the entire savings beginning in FY 2010.
5. Note that we take credit below for the total flight hours of the two excess pilots, not just their proficiency hours. This is because we assume that the tests flown by these pilots will be taken up by the remaining pilots, which in turn would reduce their proficiency hours by an equal amount. Thus, the fleetwide savings is the total hours of the excess pilots.

In summary, the Air Force would achieve a savings from merging the FHPs because it is excessing the F-16 aircraft. Table 2.2 provides a detailed analysis of these savings.

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[5] Headquarters, AFMC, 2006, p. 2.

[6] Tables B.1 through B.4 provide more information on recent activity in the FHPs at both Eglin and Edwards AFBs.

[7] This assumption was based on direction received from the 46th Test Wing Operations Group (TW/OG).

Table 2.2
Flying Hour Program Savings from AFMC Plan to Excess Three F-16s Under Combined Operations

FY 2006 Description	Data	Cost Basis
Eglin F-16 flying hour rate ($)[a]	11,369	Cost per flight hour
F-16 pilots (no.)	13	Eight attached, five assigned
Current fleet size (no.)	10	
Excess aircraft (no.)	3	
Crew ratio	0.77	Pilots (13) : Aircraft (10)
Excess pilots (no.)	2	Current crew ratio (0.77) × excessed aircraft (3) = 2.31
Total F-16 FHP	1,645	Hours per year
Flying hours per F-16 pilot	126.5	Total F-16 FHP (1,645) ÷ F-16 pilots (13)
Excess F-16 hours	253	Excess pilots (2) × flying hours per pilot (126.5)
Flying hour savings ($)	2,876,357	Excess hours (253) × Eglin F-16 flying hour rate ($11,369)
Salary savings ($)	241,040	Excess F-16 pilots (2) × officer rate (122,052)
Total annual savings ($)	3,120,461	
FYDP savings ($)	7,281,076	Annual savings above FYs 2010 and 2011 and one-third of annual savings for FY 2009

[a] Personal communication, 46th Test Wing.

46th Test Wing Maintenance

The 46th Test Wing's Maintenance Group (MXG) provides personnel, equipment, tools, materiel, vehicles, supervision, logistics, training, technical support, and other items and services necessary for managing and performing all maintenance and support tasks and functions. The test wings at both Eglin and Edwards divide maintenance work into two functional areas: maintenance other than backshop or flightline maintenance and backshop maintenance. All maintenance activities currently at the 46th Test Wing support a combined maintenance support for the 53rd Wing. Although Air Combat Command (ACC) has not analyzed the effects of the 46th Test Wing's departure in detail, the 46th Maintenance Operations Squadron Programs and Resources and 53rd Wing Manpower Office have looked into maintenance requirements for the 53rd Wing independent of the 46th Test Wing.

Flightline Maintenance (Maintenance Other Than Backshop). At the 46th Test Wing, the personnel manning this area are primarily enlisted, while at the 412th Test Wing, they are primarily civilians. Table 2.3 shows the current manning levels and distribution of the two workforces. This table reflects the entire list of AFMC Unit Manning Document positions, including the AFMC personnel that support the 53rd Wing fleet. The AFMC plan combines two maintenance activities, shifting all funding and manpower in FY 2009, then decrementing both funding and manpower in FYs 2010 and 2011, to result in the overall savings listed in Table 2.4.

The 412th Test Wing maintenance other than backshop workforce consists primarily of civilians who are part of what is referred to as a *high performance organization* (HPO). DoD created this designation in response to an FY 2004 NDAA (Public Law 108-136) requirement

Table 2.3
Flightline Maintenance: Current AFMC Labor Totals

	Civilian	Officer	Enlisted	CME	Total
46th Test Wing	87	16	553	26	682
412th Test Wing	840	11	355	19	1,225
Test wing total	927	27	908	45	1,907
53rd Wing	(3)	(4)	(209)		(216)

NOTE: In this table, the numbers for the 46th Test Wing include the maintainers who support the 53rd Wing. The last row breaks out how many of the individuals actually support that wing.

Table 2.4
Flightline Maintenance: AFMC Plan

	Civilian	Officer	Enlisted	CME	Total
46th Test Wing	69	9	292	0	370
412th Test Wing	840	11	355	19	1,225
Total manning (proposed)	909	20	647	19	1,595
Total manning (current)	924	23	699	45	1,691
Change (%)	(2)	(13)	(7)	(58)	(6)

for federal agencies to submit candidates for HPOs. The conversion of military enlisted positions to civilian positions was a key requirement for the HPO designation. DoD approved the 412th MXG as an Air Force HPO pilot project, and the group has been operating as such for a year.

The immediate change was to convert 918 military positions to 453 civilian civil-service slots, resulting in an immediate manpower savings—nearly a two for one savings on the conversion to a civilian organization. To remain an HPO program, the savings must continue to be demonstrated over the five years of this program.

Effect of Moving to Edwards AFB. The AFMC plan did not specifically address the effects on the 53rd Wing. The AFMC plan combines the two maintenance activities, shifting all funding and manpower in FY 2009, then decrements both funding and manpower in FYs 2010 and 2011, with the results in Table 2.4. Overall, the AFMC plan reduces 96 positions, from the original 1,691 positions to the planned 1,595. This is a net change (reduction) of 6 percent, based primarily on the idea that combining organizations will result in efficiencies.

Findings. Our analysis rejects the AFMC claim that a 6-percent efficiency could be achieved. We believe the savings for AFMC are greater. Our first challenge was to identify how many of these maintainers were associated with the specific workload that is scheduled to move to Edwards. This workload, as discussed previously, includes maintaining a total of 16 aircraft.[8] Included in the total number of maintainers listed in Table 2.3 for the 46th Test Wing is the workload associated with the AFMC support of the 11 ACC aircraft for the 53rd Wing. In addition, the 46th Test Wing FHP will leave behind several aircraft (two UH-1s and

[8] Seven F-15s, seven F-16s (the current total is ten F-16s, but AFMC will excess three of these), and two A-10s.

one C-130) that will require a small cadre of maintainers (31 flightline maintainers and 27 backshop maintainers will be required).[9] We examined two possible scenarios for calculating the savings that could result from the consolidation.

The first scenario assumes a simplified approach to developing a ratio of current aircraft maintained to current number of maintainers required. This approach was used to determine only the number of people that would move to the 412th from the 46th Test Wing to support the 16 aircraft also proposed to move. Leaving behind the 31 maintainers required for the support of the UH-1 and C-130 aircraft to remain at Eglin provides a ratio of 24 maintainers to each aircraft.[10] If 24 maintainers per aircraft are required and 16 aircraft will move to the 412th Test Wing, a total of 384 maintainers will be required to move with the workload. We also need to calculate nonrecurring costs that would be required as part of the consolidation. First, 20 percent of the civilian workforce (17) would permanently change station, at a cost of $35,496 per person. The remaining 66 civilians would have to be hired at Edwards. Throughout this monograph, the assumption is that civilian hiring costs 50 percent of one year's salary for each hiring action to cover the cost of recruitment activities.

Cost Savings Summary for Scenario 1. To summarize the costs and savings for flightline maintenance scenario 1:

- annual recurring savings: $16.7 million
- nonrecurring (transition) costs: –$3.9 million[11]
- FYDP savings (FYs 2009–2011): $46.3 million
- payback period: less than one year (beginning in FY 2009).[12]

The second scenario results in a greater savings and is based directly on information received from the 412th Test Wing Maintenance HPO. The 412th provided us with an estimate from its HPO manpower model, a tool that tracks manpower requirements for flightline maintenance and can be used to predict the required manpower for the gaining workload. This information from the 412th indicates that the flightline maintenance can be accomplished with 177 people, but this estimate includes the following assumptions:

- The 412th specifically states that a definitive number cannot be determined until a full HPO analysis is performed. This could result in either a lower or higher number.
- With the exception of the 216 maintainers associated with 53rd Wing fleet maintenance and the 31 maintainers for the remaining AFMC aircraft (UH-1s and the C-130), all remaining personnel move in the first year. In FYs 2010 and 2011, reductions and military-to-civilian conversions would occur at a rate of 50 percent each year to achieve an end state of 177 total new positions at the 412th Test Wing.

Nonrecurring costs with this scenario assume the same PCS costs as for scenario 1. In addition, we assume that 160 civilians will be hired as part of the military-to-civilian conver-

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[9] Information received from 46th Test Wing personnel, April 3, 2007.

[10] Starting from 682 current maintainers less the 31 to remain at Eglin yields 651 maintainers times the 27 total aircraft (11 in the 53rd Wing fleet plus 16 in the AFMC fleet moving from Eglin) times 16 AFMC aircraft.

[11] This includes PCS costs of $0.6 million and civilian recruitment costs of $3.3 million.

[12] See Table B.10 for supporting information.

sions over the two-year period (FYs 2010 and 2011), resulting in a total recruitment cost of $8.1 million.

Cost Savings Summary for Scenario 2. The savings from flightline maintenance scenario 2 reduce the current workforce from 466 to 208 (177 at the 412th Test Wing and the remaining 31 at the 46th Test Wing). As a result, the costs savings from this second scenario are as follows:

- annual recurring savings: $27.5 million
- nonrecurring (transition) costs: –$8.6 million[13]
- FYDP savings (FYs 2009–2011): $53.4 million
- payback period: less than one year (beginning in FY 2009).[14]

These savings in flightline maintenance for the 46th Test Wing and AFMC will be offset by the additional personnel required by the 53rd Wing in ACC. It would reportedly require 216 personnel for the MXG staff, Maintenance Squadron (MXS), MOS, and aircraft MXS functions.[15] These personnel are currently assigned to the 46th Test Wing, so the 53rd Wing will need to add these 216 manpower slots to its organization, at an additional cost of $13.5 million per year. In addition, to support the aerospace ground equipment (AGE), an additional 23 personnel are required at a cost of $2.1 million per year.

Backshop Maintenance. Both the 46th and 412th Test Wings operate aircraft backshop repair functions, providing propulsion, avionics, accessory, and armament system maintenance, fabrication, maintenance control, nondestructive inspection, structural repair, and metal technology.

The 46th Test Wing conducts backshop repair primarily with a contractor workforce. The wing's backshop repair group completed an A-76 study competition several years ago, a process in which the workload is competed between organic (civilian and/or military) and contractors. The backshop repair activity at the 46th Test Wing was subsequently awarded to a contractor workforce. Of the current 164 personnel assigned to backshop maintenance, 155 are contractors. The current intermediate aircraft maintenance contract at the 46th Test Wing provides labor, equipment, tools, materiel, vehicles, supervision, logistics, training, technical support, and other items and services necessary for managing and performing backshop maintenance and support tasks.

At the 412th MXS, the workforce is primarily civilian. Of the 564 positions authorized, 496 are filled by civilian personnel. These personnel perform on- and off-equipment maintenance and logistics T&E support.

Effect of Moving to Edwards AFB. The AFMC plan would move the maintenance function from Eglin AFB to Edwards AFB. Overall, the plan would shift all funding and manpower in FY 2009, then decrement both funding and manpower in FYs 2010 and 2011, to result in the overall savings listed in Table 2.5. The table represents the current manning levels at both locations and clearly shows the workforce structure and the balance between contract and civilian personnel. As these workforces merge, the AFMC plan would replace the contrac-

[13] This includes PCS costs of $0.6 million and civilian recruitment costs of $8.1 million.

[14] We elected to use flightline maintenance scenario 2 for our in-depth cost estimates. See Table B.11 for supporting information.

[15] Personal conversation with 46 MOS and 53 Wing Manpower Office.

tor workforce at the 46th Test Wing with civilians, as shown in Table 2.6. This plan would increase the civilian workforce from 7 to 106 and remove the 155 contractor personnel for the 46th Test Wing workload. The AFMC plan would result in an 8-percent efficiency as a cost savings, as reflected in Table 2.6.

Findings. Instead of using the AFMC plan, which appears to have taken a straight percentage manpower reduction, we used two different scenarios to develop cost savings, both approaches derived from a simple ratio model of manpower required to support the current fleet level. Scenario 1 begins by developing this ratio of maintainers to aircraft. Our first challenge was to identify how many of these maintainers are associated with the specific workload that is scheduled to move to Edwards AFB. This workload, as discussed previously, includes a total of 16 aircraft. From a total of 164 people assigned to the backshop, 27 will stay in place at the 46th Test Wing to support the aircraft remaining at Eglin AFB (two UH-1s and one C-130). The ratio of maintainers to each aircraft nets to five.[16] If five maintainers per aircraft are required and 16 aircraft will move to the 412th Test Wing, then a total of 82 maintainers will be required to move with the workload.

This analysis also includes several nonrecurring costs. Discussions with the 412th Test Wing, along with subsequent OSD-required funding exhibits,[17] indicate that moving the 46th Test Wing backshop maintenance activities would require a new military construction project to house the munitions moved from Eglin to Edwards.[18] The total cost for this project was estimated at $31 million, with construction to begin in FY 2009.[19] This project divided into a

Table 2.5
Backshop Maintenance: Current Labor Totals

	Civilian	Officer	Enlisted	CME	Total
46th Test Wing	7	0	2	155	164
412th Test Wing	496	0	67	1	564
Total	503	0	69	156	728

Table 2.6
Backshop Maintenance: AFMC Plan (operation after combination)

	Civilian	Officer	Enlisted	CME	Total
46th Test Wing (proposed)	106	0	2	0	108
412th Test Wing (proposed)	496	0	67	1	564
Total manning (proposed)	602	0	69	1	672
Total manning (current)	503	0	69	156	728
Change (%)					(8)

[16] Starting from the 164 current backshop maintainers less the 27 maintainers to remain at Eglin yields 137 maintainers divided by 27 total aircraft (11 in the 53rd Wing fleet plus 16 in the AFMC fleet moving to Edwards).

[17] Major Range and Test Facility Base Exhibits, September 2006.

[18] The plan calls for constructing seven large and four small earth-covered igloos, four multibay reinforced concrete munitions maintenance facilities, five storage shelters, and one drive-through igloo; adding to and altering existing facilities; and constructing a live munitions facility.

[19] AFFTC/FMC, *Economic Analysis, Munitions Storage Phase 1*, August 2006.

near-term phase and beyond-FYDP phase. For the purposes of this CBA, we have included the entire military construction effort as a cost in FY 2009. Discussions with the 412th Test Wing indicate that, if the military construction project is not funded early enough for the military construction to be complete before the consolidation, additional costs will be accrued for just-in-time storage and transportation of munitions off site.

We also included transportation costs for the support equipment for maintenance activities. The AFMC Directorate of Strategic Plans and Programs' list of potential support equipment that would be moved with the maintenance function runs to more than 1,400 line items. The subject-matter expert at the AFMC Directorate of Logistics, Logistics Readiness Division estimates that the cost for this move would be $5 million. This does not involve a per-pound estimate using BRAC's COBRA standards because much of the relocation cost would be a function of the size and weight of the equipment being moved. Many of these items will likely have to be disassembled to be moved. The logistics directorate is working with the Surface Deployment and Distribution Command for a complete estimate. The amount of support equipment that would actually need to move is likely to be minimal. If the 53rd Wing remains at Eglin AFB, the most efficient plan would be to transfer this equipment to the activities remaining for the 53rd Wing. The majority of the necessary support equipment for the combined organization is already in place at Edwards AFB. We have taken into account the transition costs for hiring and firing members of the workforce. Finally, we have taken into account the transition costs for civilian recruitment and firing for the contractor workforce at Eglin.

Backshop maintenance cost savings (in FY 2007 dollars), primarily the results of manpower savings, are projected as follows:

- annual recurring savings: $3.8 million
- nonrecurring costs: –$40.1 million
- FYDP savings (FYs 2009–2011): –$28.6 million
- payback period (years): 10.4 years (starting in FY 2009).[20]

Scenario 2 is exactly the same as scenario 1 but reduces the backshop manning level by nine from the current level of 164, for a total of 155. Our assumption is that these nine positions represent overhead and administrative civilians and enlisted personnel who could remain in place to support 53rd Wing operations. The 412th Test Wing already has essentially the same support in place and would not need more for the combined operation. The same calculation would result in a current combined (46th Test Wing and 53rd Wing) workforce of 128 maintainers (155–27 remaining for the C-130 and the UH-1s). The 128 maintainers for 27 aircraft (11 aircraft for the 53rd Wing and 16 for AFMC) equates to 4.7 maintainers per aircraft. The net 76 maintainers will move with the 46th Test Wing aircraft. The resulting savings is the difference between the current manning level (155) and the proposed new level (103).[21] The same nonrecurring costs also apply, with slight differences for recruitment and termination costs. Our calculations yield the following savings results:

- Annual recurring savings: $4.4 million
- Nonrecurring (transition) costs: –$41.1 million

[20] We elected to use backshop maintenance scenario 1 for our in-depth cost estimates. See Table B.8 for supporting information.

[21] So, 76 will move to Edwards, and 27 will stay at Eglin to maintain the remaining aircraft.

- FYDP savings (FYs 2009–2011): –$27.8 million
- Payback period: 9.3 years (beginning in FY 2009).[22]

As with flightline maintenance, a portion of the 46th Test Wing savings for AFMC will be offset by additional expenses for ACC's 53rd Wing. Several years ago, the 46th Test Wing employed 319 personnel in the maintenance backshop, 92 of them funded by the 53rd Wing.[23] That facility underwent an A-76 conversion to contractor personnel, which resulted in a reduction to 164 personnel and the 53rd giving up the 92 manpower positions. As a result, the 53rd Wing does not currently pay for any of its backshop maintenance, although its overall maintenance budget is also lower than would normally be expected.

According to the 46 MOS/MXOP analysis, a maintenance backshop for the 53rd alone would require 124 personnel, a reduction of 40 from the current level. Hence, when the 46th Test Wing leaves, it would transfer 124 of 164 backshop personnel to the 53rd Wing (presumably firing or transferring the additional 40 to other duties). These 124 additional personnel, to be funded by the 53rd and ACC, cost $11.3 million per year.[24]

Note that the proposed backshop manning for the 53rd Wing, 124 personnel, gives a ratio of 11.3 maintainers per aircraft. This is much higher than the current level of 5.1 per aircraft in the current combined 46th Test Wing–53rd Wing operation. Although we would expect this ratio to increase somewhat because of the need for maintenance overhead personnel, an increase of more than two times seems excessive. As a parametric excursion we will call scenario 2 to correspond with the accompanying case in the 46th analysis, we computed a 53rd backshop size using current personnel ratios and assuming a current level of maintenance overhead manning. Today, the backshop has 128 contractors and nine civilian and military, for a total of 137 (after the personnel needed for the two UH-1s and one C-130 are removed). If we assume the nine individuals are the maintenance overhead, the true maintainer-to-aircraft ratio is 4.7 (128 divided by 27). For the 53rd Wing's 11 aircraft, this results in a requirement of 53 maintainers. Adding back the nine overhead personnel then produces a total backshop size of 62, or exactly one-half the size proposed by the 46 MOS/MXOP. This backshop would be an additional cost to the 53rd Wing and ACC of $5.6 million per year and $16.9 million over the FYDP.

The final maintenance-related cost element would come from any support equipment the 53rd Wing required but that the 46th Test Wing had taken to Edwards AFB. Correctly accounting for this cost requires the 46th Test Wing to decide specifically what equipment it must take and what it can leave at Eglin. Obviously this will require close coordination with the 412th Test Wing at the AFFTC, which has not occurred. According to ACC, the maximum needed support-equipment procurement would be as follows, in FY 2007 dollars:

- $33 million (for the F-15 only)
- $18 million (for the F-16 only)
- $39 million (common to both aircraft).[25]

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[22] Table B.9 breaks out the specific manpower calculations used in this analysis and lists the nonrecurring costs.

[23] 46 MXG, 2007.

[24] Table B.12 provides supporting information.

[25] ACC, 2007.

Again, this is reportedly a complete list of support equipment, the procurement of which may not be necessary depending on what the 46th Test Wing leaves behind. It appears logical that the 46th Test Wing could leave most of its support equipment behind because it would be merging with the 412th Test Wing, and the 53rd Wing requires only one-third of the current total at Eglin AFB. We therefore assume that there is no additional support equipment cost to the 53rd Wing.

Support Staff Reductions

Overview. The AFMC plan reduces staff in several areas, and savings accrue primarily from manpower reductions. We describe these reductions in two main areas:

1. staff activities performed at both locations that are similar and presumably redundant; these functions do not move to Edwards in the AFMC plan
2. miscellaneous AFFTC center and wing staff reductions.

Activities Not Moving to Edwards. AFMC's plan does not move certain staff activities to Edwards. It is understood that some of the support staff—such as the 46th Test Wing commander and staff, the directorate and division heads, and portions of the flight support and other miscellaneous 46th Test Wing support staff—would become redundant with the consolidation. Ultimately, these redundant positions would not be moved. The personnel not moved under the AFMC plan include the following:

1. The 46th Test Wing staff, which consists of the wing or group commander, vice commander, command chief, and miscellaneous front-office support staff. Various other wing support functions are also part of these activities, including plans and programs, information technology, resources, strategic initiatives, security, contracting, financial management, and personnel services. A small staff would remain at Eglin.
2. The 46th Test Wing test staff, which consists of such test-support personnel as specialized engineers, programmers, and contractors. These personnel plan, execute, and report on various types of developmental testing and are trained and certified in specific functions.
3. Flight operations support personnel, who plan, execute, and report on various types of testing.
4. Miscellaneous 46th Test Wing personnel, including plans and programs, vehicle operations, additional information technology management, and safety offices personnel.

The total manpower and projected AFMC savings are presented in Table 2.7.

Staff Reductions at the 412th Test Wing. The AFMC plan also significantly reduces the center and wing staff at Edwards AFB, from 809 positions to 587 positions. From a combined support-staff perspective, the support staff reductions at AFMC represent an overall reduction of 42 percent (Table 2.8).

Support Manpower Conclusions. AFMC's 2006 proposal projected that merging staff personnel from the 46th and 412th Test Wings would yield an efficiency savings of 41 percent. To understand whether or not this number was reasonable, we did three things:

Table 2.7
Total 46th Test Wing Manpower Savings from Activities That Do Not Move

	Manpower Savings		
Activity	**Budget**	**Proposed**	**Savings**
46th Test Wing test staff	17	0	17
Flight support	47	0	47
46th Test Wing staff[a]	145	29	116
Miscellaneous 46th Test Wing	224	121	103
Total	433	150	283

[a] These numbers do not include the staff located at Holloman AFB.

Table 2.8
Manpower Savings from Support Staff Functions at Both Locations (46th and 412th Test Wings)

	Manpower Savings		
Activity	**Budget**	**Proposed**	**Savings**
46th Test Wing test staff	17	0	17
Flight support	47	0	47
46th Test Wing staff	145	29	116
Miscellaneous 46th Test Wing	224	121	103
AFFTC and wing staff	809	587	222
Total	1,242	737	505
Reduction (%)			41

1. interviewed USAF personnel to understand details associated with the potential merge
2. conducted a literature search on the mergers and associated personnel savings
3. spoke with subject-matter experts experienced in merger activities.

We discovered from the literature review and discussions with subject-matter experts that no "norms" or "standard ranges" of savings are typical for mergers like the one proposed in AFMC's consolidation case. On the contrary, savings associated with mergers are very difficult to assess and, as one source indicated, "idiosyncratic"—very specific to the case being studied. Given that the workload requirements would remain relatively the same and even though the two support staffs could produce some degree of efficiency through economies of scale, we considered the AFMC plan for a 41-percent efficiency not to be executable.

As we assessed this specific merger, we discussed the potential savings with Air Force personnel and considered

- the purpose of the merger
- its objectives
- the Air Force's desire to keep a viable staff that could supervise existing activities.

For purposes of this CBA, we assume an efficiency of 30 percent after the 46th Test Wing merges with Edwards center and wing staff. The AFMC plan moves none of the 46th Test Wing support staff to Edwards. We maintain that some of this staff should be shifted with the 46th Test Wing workload. Thus, our assumptions for this CBA reduce the overall workforce levels by 30 percent instead of 41 percent and assume these savings are all taken by reducing the contractor workforce.

We calculated nonrecurring transition costs for contractor layoffs at Eglin and Edwards. We also applied both PCS costs for the civilian workforce that would move to Edwards as well as new recruitment and hiring costs for civilians that would have to be hired at Edwards.[26]

We received several comments from both the 412th and the 46th Test Wings that indicate that the manpower cuts for both the 46th Test Wing staff and the AFFTC center and wing staff may require further analysis to determine the actual levels of manpower necessary to sustain current operations. The reductions to these staffs may not only include reductions to the contractor workforce but may also affect specific contracts that do not require labor. The 46th Test Wing staff provided information that may require more positions to remain at Eglin than the original AFMC plan assumed. Although the RAND analysis recommends a much lower overall reduction to the support personnel than AFMC's recommended level, we further suggest considering a full, bottom-up manpower study before implementing the recommended staff support reductions. The final results are a projected savings for staff support, as follows, in FY 2007 dollars:

- annual recurring savings: $37.3 million
- nonrecurring costs: –$9.6 million
- FYDP savings (FYs 2009–2011): $102.3 million.
- payback period: less than one year.[27]

Miscellaneous AFMC Test Wing Reductions Not Included in This CBA

This CBA does not address several areas of the original AFMC plan. As we have already mentioned, the AFMC proposal was driven by budget cuts to meet PBD-720 objectives. Several areas within the AFMC proposal appear to be driven primarily to meet budget-cut objectives instead of being related to the issues of consolidating the test wings. In addition, limited information and studies are available to support specific factual analysis for the majority of the manpower reductions that follow. For clarity and for tracking with the AFMC plan, we mention these areas below; however, RAND did not specifically address any of these because of a determination that either (1) the manpower reductions are cost neutral or (2) the reductions are not relevant to the test wing consolidation.

46th Test Wing Resource Earning Units That Move

The AFMC plan includes moving 487 people from the 46th Test Wing in a category of study titled "REUs that move." The plan moves nearly the entire workforce, with a minor change

[26] We assumed that 20 percent of the 46th Test Wing workforce would move to Edwards—the remaining personnel would have to be new civilian hires.

[27] Table B.5 breaks out the funding and manpower data that fed into our calculations.

in total manpower to 478 positions by FY 2011. The primary effect of the AFMC plan would be to change the mix of personnel. Specifically, contractor personnel would ramp down from 277 in FY 2007 to 185 in FY 2011. Conversely, civilian positions would increase from 153 in FY 2007 to 212 by FY 2011.

With the exception of a one-time, nonrecurring cost to move 20 percent of the civilian workforce ($1.5 million[28]), we determined that the results would be cost neutral and so did not include this in our CBA. We do note that these positions are part of the total personnel that would be required to move with the 46th Test Wing and include the required engineers, program managers, and support staff. The positions represent specific skills for weapon testing and support and for the F-15 OFP. Specifically, the required positions include the following:

- Personnel from the 780th Test Squadron include those who plan, execute, and report on the testing of air-to-air missiles, launchers, and scoring systems and on ground and flight testing for weapon testing development, avionics system integration, navigation systems, and guided weapons, as well as munitions tests involving terminal effects, lethality, target vulnerability, warhead characterization, fuzes, guns, ammunition, and modeling and simulation.
- Technical support personnel include all those providing engineering, science, financial, and acquisition support. Engineering and scientific support includes ground- and flight-test planning, execution, data analysis and reduction, and technical report writing.
- Personnel from the 40th Flight Test Squadron are aircrew, such as test pilots,[29] weapon systems officers, and flight-test engineers.
- For F-15 OFP testing, the OFP combined test force (CTF) is responsible for managing F-15A/E flight-test programs. It develops test concepts; prepares test plans; manages test execution; analyzes data; and produces test briefings, reports, and fielding recommendations.

According to the 412th Test Wing, it should be noted that transferring these positions is critical. Not doing so would put the uninterrupted operation of these test capabilities at risk.[30]

412th Test Wing REU

The AFMC plan also cuts funding from the 412th Test Wing resource earning unit (REU). These reductions appear to have been driven by budget cuts in the AFMC plan and are not specifically related to the test wing consolidation; therefore, we did not address these savings in this monograph. For informational purposes, this "REU" is a "bundle" of five REUs, all CTF facilities: The Airborne Laser, Global Power Bomber, Global Reach, Global Vigilance, and Global Power Fighter. Each of these CTFs is made up of representatives from the Air Force Flight Test Center, participating test organizations, Air Force Operational Test and Evaluation Center, and using and support commands and contractors. The CTF is responsible for all aspects of planning, coordinating, managing, flight operations, safety, testing and reporting

[28] This is the cost of moving 20 percent of the 212 civilians at $35,496 each.

[29] This CBA does include test pilots, in the FHP analysis.

[30] Personal correspondence with the 412th Test Wing.

of T&E, and supporting initial operational T&E and follow-on T&E programs. According to both AFMC and AFFTC personnel, these reductions, coupled with the consolidation, present a significant challenge for producing an executable organization.

C4ISR

AFMC's budget-driven manpower cuts reduce the contractor workforce and increase the civilian workforce. The positions and C4ISR workload remain at Eglin and are not part of the test wing consolidation activities. This monograph does not address this area.

Arnold Engineering Development Center Contractor Staff and Information Technology

According to further clarification from AFMC/A3 personnel, the cuts levied on the Arnold Engineering Development Center (AEDC) reduce information-technology contractor support. This support provides management of resources and equipment as they relate to personal computers, network services, servers, Web access, telephones, and other information technology functions. The contractor reductions in this area are also not related to the test wing consolidation. This monograph does not address this area.

Effect of Changes at Eglin AFB on the 53rd Wing

Although not explicitly addressed by the AFMC plan, the changes to take place at Eglin AFB will have a significant effect on the 53rd Wing. We examine each of the major effects in turn, beginning with facility closures, moving to range capacity reductions, and finally to the loss of 46th Test Wing support. We conclude this section with a short discussion of possible alternative courses of action for the 53rd Wing at Eglin other than the baseline case of remaining in place.

Wing Activities at Eglin

The 53rd Wing is a major tenant of Eglin, with approximately 850 personnel and 11 aircraft.[31] The wing has a major role in operational testing and tactics development for ACC and has 29 aircraft based at Nellis; 11 at Eglin; one at Holloman AFB; two at Barksdale AFB, Louisiana; and six at Creech AFB, Nevada. The wing includes four major groups: the 53rd Electronic Warfare Group (EWG), the 53rd Weapons Evaluation Group, the 53rd Test and Evaluation Group, and the 53rd Test Management Group.

Although the 53rd Wing reports to the Air Warfare Center at Nellis AFB and has the largest number of aircraft based there, the wing headquarters and many flight-test activities are at Eglin. The EWG and Test Management Group account for approximately 700 of the 850 staff members, with the remainder in wing headquarters (70) and in the weapon evaluation and T&E groups (40 each). As mentioned, 11 of the wing's aircraft are at Eglin in the form of block 40/50 F-16s, F-15Cs, and a single F-15E.[32] These aircraft form the 85th Test and Evaluation Squadron.

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[31] ACC, 2007.

[32] USAFWC, 2006.

As can be seen in the personnel mix, EW test and reprogramming activities account for a large portion of the 53rd Wing's activities at Eglin, where the EWG can develop changes and quickly ground-test them at the Joint Preflight Integration of Munitions and Electronic Systems (J-PRIMES) facility or flight test them on the range using the Multi-Spectral Test and Training Environment (MSTTE) capability. The wing's activities at Eglin also include Operational Flight Program testing in conjunction with the 46th Test Wing and chemical-biological defense testing with the 28th Test and Evaluation Squadron at the Eglin range and facilities.[33]

Effect of Facility Closures

The 53rd Wing primarily uses two facilities at Eglin AFB: J-PRIMES and MSTTE. Both facilities are used in concert for ground and open-air testing for electronic-warfare tape development, reprogramming, and validation. Closure of either or both of these facilities would obviously have a major effect on many of the 53rd Wing's activities. J-PRIMES, which accounts for approximately 70 percent of mission data-tape testing, allows testing a full-up aircraft with RF sensors and emitters against a simulated threat environment to exercise new and updated software.[34] The MSTTE threat simulators are used in conjunction with the open-air testing facility for similar instrumented EW evaluation.

Although J-PRIMES and MSTTE are both important to the 53rd Wing's mission, the wing's activities themselves do not come close to fully using these facilities. In the J-PRIMES FY 2007 schedule, the 36th Electronic Warfare Squadron, part of the 53rd Wing's EWG, is scheduled for almost a month's work in the main chamber and a similar amount of U-2 testing outside the anechoic chambers. There is also continuing work on "SUMMER Dev," which is scheduled for continuous use throughout the fiscal year outside the chambers.[35] From these data, it appears that 53rd Wing activities account for less than 10 percent of J-PRIMES use.

Measuring the use of the MSTTE is difficult because many of its capabilities could be used simultaneously by different users. However, 53rd Wing's utilization rate for test sites A-30 and A-31, where threat emitters are located, is 30 percent.[36] For comparison, these test areas are utilized at 48 percent by the 46th Test Wing and 65 percent for training, making the 53rd Wing the least frequent user.

From these results, it appears that the AFMC plan to close J-PRIMES and reduce the capacity of the MSTTE will greatly affect the 53rd Wing's EW testing activities. At the same time, however, these activities are not significant enough by themselves to support the facilities. There are, however, possible alternatives to these capabilities that the 53rd could use. For J-PRIMES, the three most commonly identified alternatives are a U.S. Army takeover of the facility, use of the Benefield Anechoic Facility at Edwards AFB, or testing at the Navy's Air Combat Environment Test and Evaluation Facility (ACETEF) at Patuxent River, Maryland. The 53rd Wing has estimated that its additional cost would be a nonrecurring charge of $160,000. No details were provided on the makeup of that charge. The Benefield Anechoic

[33] USAFWC, 2006.

[34] USAFWC, 2006.

[35] Riemer, 2006.

[36] Dyess, 2007d. This utilization is defined as a percentage of possible duty days that were scheduled at least once a day by the organization. So in this case, with 224 possible duty days per year, the 53rd Wing tested at least once on 67 of them.

Facility is also slated for significant reduction in the AFMC plan, so it may not be a reasonable alternative. The Navy has studied the use of the ACETEF as a J-PRIMES alternative and concluded that it could take on 32 percent of the J-PRIMES workload at a cost of $3 million per year. However, taking on all the testing would require an additional chamber, at a one-time cost of $24 million.[37] Presumably, additional staff would be necessary as well. Although the ACETEF could reportedly take on the 53rd Wing's J-PRIMES testing activities at relatively low cost, it is doubtful that there would be sufficient capacity for all of it. This would imply shifting the 53rd Wing's share from 10 percent at J-PRIMES to 30 percent at the ACETEF. Such a priority shift would be unlikely. Furthermore, if the 53rd Wing remains at Eglin AFB, as the AFMC plan assumes, all the tests would require personnel and aircraft deployments and travel delays, at significant extra cost. Additional analysis with detailed access to the 53rd Wing's test schedule and cost structure would be necessary to calculate the size of these costs.

The best alternative for the MSTTE appears to be the China Lake Electronic Combat Range (Echo Range). According to the Naval Air Systems Command's (NAVAIR's) analysis, this facility appears to be able to take on the entire MSTTE workload, of which the 53rd Wing's portion should be around 30 percent, if future schedules remain similar to today's.[38] The primary unknown issue is whether the Echo Range has the appropriate number and type of threat systems. Addressing this issue would likely require analysis at a classified level. As with J-PRIMES alternatives, additional costs to the 53rd Wing and ACC would arise because of the need to deploy personnel and aircraft from Eglin to China Lake, if the 53rd Wing remains in Florida. Also, aircraft test instrumentation, particularly telemetry, may need modification to be compatible with China Lake's range. As with the J-PRIMES, these costs would require further analysis using the 53rd Wing's test schedule and costs for the calculations. However, the 53rd Wing did provide an analysis of its costs should both the J-PRIMES and MSTTE facilities completely close. The additional annual cost was calculated to be $800,000 per year.[39] Although no details were provided, this amount is presumably to cover additional temporary duty and deployments to alternative facilities.

Effect of Overall Range Capacity Reduction

A major portion of the cost savings the AFMC plan would realize would result from personnel cuts across the Eglin range. The reduced range was planned by AFMC to handle only deployed tests and AFSOC and C4ISR developmental testing, resulting in staffing levels being cut by approximately 75 percent.[40] Table 2.9 illustrates the test missions scheduled in FY 2006, with the current personnel levels. Note that the table shows only testing missions, not training. As expected, missions flown by 53rd Wing aircraft account for around 10 percent of the total range utilization, and these missions are split between 53rd Wing–specific activities and the Operational Flight Program testing as part of the Combined Test Force. Note that the

[37] NAVAIR, 2007a. These additional costs are being tabulated in Chapter Four and so are not included here.

[38] NAVAIR, 2007b. In its analysis, NAVAIR originally used low values for the MSTTE workload (one additional operation every two weeks instead of two operations per week). Follow-up with NAVAIR indicated that this higher workload could still be easily accommodated because the typical workload is currently 13 to 14 operations per week.

[39] This cost would be incurred only if the J-PRIMES and MSTTE were to close and is based on inputs from the 53rd Wing. Per the analysis conducted in this monograph, we do not find that J-PRIMES or the MSSTE should close.

[40] Dyess, 2007d.

Table 2.9
Scheduled Eglin Range Test Missions in FY 2006

Test Organization	Aircraft			Total Missions
	46th Test Wing	53rd Wing	Other	
40th Flight Test Squadron	500		13	513
46th Test Squadron	109		510	619
780th Test Squadron	192		25	217
53rd Wing		85	260	345
Operational Flight Program Combined Test Program	117	119		236
413th Test Squadron	11		88	99
46th Test Wing Range Management Squadron	65		405	470
Air Force Operational Test and Evaluation Center (AFOTEC)			5	5
Air Force Special Operations Command (AFSOC)			1	1
Total	994	204	1,307	2,505
Percentage	40	8	52	

SOURCE: Dyess, 2007d.

53rd Wing's 11 aircraft flew 204 test missions on the Eglin range during the year—approximately one test mission per aircraft every 13 days.

As with the other facilities, the 53rd Wing has a relatively small effect on the Eglin open-air range. On the other hand, if the range capacity is reduced by 75 percent, it would likely be difficult to accommodate all the 53rd Wing's testing without a large shift in priorities in favor of the 53rd Wing. There are several possible alternative locations for open-air flight testing. Analysis by the 46th and 412th Test Wings in conjunction with NAVAIR has indicated that most of Eglin's test activities could be accommodated on a combination of the Edwards, China Lake, and Point Mugu ranges.[41] Chapter Three addresses many of the capability and capacity issues, such as spectrum availability, but the additional cost entailed by the 53rd Wing for personnel and aircraft deployment requirements will require further analysis with detailed access to the appropriate data.[42] Estimates of additional costs to the 53rd Wing cannot be considered complete until such an analysis is completed.

Effect of the 46th Test Wing Relocation

The 46th Test Wing provides many supporting services for the 53rd Wing, some directly paid for, some subsidized. In general, these supporting activities can be characterized as operational

[41] Dyess, 2007c.

[42] Personal communication with telemetry specialists at Edwards indicated a cost of around $35,000 per aircraft to upgrade to more modern, less-bandwidth-intensive telemetry equipment. Total nonrecurring cost for the 53rd Wing's 11 aircraft would then total $385,000.

support and aircraft maintenance. For the most part, neither the 53rd Wing nor ACC has performed detailed analysis on the effects of the AFMC plan, so most of what is reported here comes from individuals in the 53rd Wing and the 46th Test Wing and should not be considered official positions.

Generally speaking, if the 46th Test Wing leaves Eglin, the 53rd Wing is not manned to take over the functions of a traditional operations support squadron (OSS). The 53rd Wing provided a rough accounting of the necessary manpower, shown in Table 2.10.

Although the personnel needed total 203, this likely significantly overstates the real difference should the 46th Test Wing leave, since the AFMC plan specifies that several relevant organizations will remain at Eglin. These are noted in the top half of Table 2.10 and account for the vast majority of personnel. The functions new to the 53rd Wing add up to a manpower

Table 2.10
Operational Support Manning Needed for 53rd Wing

Position	Staffing
46th Test Wing leaves behind	
Airfield operations	14[a]
Airfield management	22[a]
Radar control	66[a]
Control tower operations	29[a]
Life support	6[b]
Operations system management	4[b]
Weather squadron	23[c]
Operations plans	4
Subtotal	168
53rd Wing to recreate	
Commander	2
Squadron section commander	3
Weapons and tactics	5
Current operations management	11
Scheduling and current operations	2[b]
Operations training	2[b]
Simulator management	0
Intelligence	10[d]
Subtotal	35
Total	203

SOURCE: 53rd Wing Manpower Office, 2007.

[a] Current 46th Test Wing.

[b] Air Force Manpower Standard.

[c] Range requirement.

[d] Primary aircraft inventory–driven.

requirement of 35. This figure agrees fairly well with ACC's estimate of 40 new personnel.[43] We use the slightly higher number for our cost calculation. The personnel mix of military enlisted, officers, civilians, and contractors for this 40-person addition remains unclear. For the sake of simplicity, we use the same mix as the 46th OSS currently operates: 23 percent enlisted, 15 percent officer, 32 percent civilian, and 30 percent contractor.[44] This may be somewhat in error because of the mix of functions that remain and that need creating but should not have a major effect on the cost calculations.

As with the other elements of this analysis, we use the FY 2007 Total Annual Average Standard Composite Rates from Air Force Instruction (AFI) 65-503 for military enlisted and officers and a standard fully burdened rate of $100,000 per year for civilians and contractors. With the 46th Test Wing expected to complete its move to Edwards AFB by FY 2009, we would add the extra personnel to the budget in that year. In FY 2007 dollars, the annual cost for the 40 extra operations-related personnel would be approximately $3.5 million.

Cost Summary

To summarize the additional costs to be incurred by the 53rd Wing, we simply sum the expenses discussed here over the FYDP.[45] In addition, some elements of the additional costs have not been tallied, particularly extra test costs to the wing as a result of having to perform some of its operational testing at locations away from Eglin. It would be necessary to analyze the 53rd Wing's planned test schedule and cost accounts in some detail to make a reasonable assumption about these costs. The available costs total as follows, in FY 2007 dollars:

- J-PRIMES and MSTTE closure: $800,000 per year
- operations personnel: $3.55 million per year
- backshop personnel: $11.26 million per year
- flightline personnel: $15.64 million per year
- support equipment: $0 to 90 million.

If we assume no additional support equipment is required, the costs over the FY 2007 through 2011 FYDP total $93.75 million. This is calculated as follows:

$$3 \text{ years (2009 through 2011)} \times (0.8 + 3.55 + 11.26 + 15.64) = \$93.75 \text{ million.}$$

Again, the actual effect may be somewhat larger than this if the remaining open-air range capability is insufficient because the wing will incur additional test costs as it is forced to test at remote locations, such as Edwards AFB or China Lake.

Other Alternatives for the 53rd Wing

As expected, if the AFMC plan is executed, the 53rd Wing will incur a significant negative cost effect. The baseline case assumes that the 53rd Wing remains in place at Eglin with no noteworthy changes. This may not be the most cost-effective approach if the plan is executed.

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[43] USAFWC, 2006.

[44] 46 TW/XPR, 2007b.

[45] NPV calculations over a 30-year period are also included in Appendix B.

Although the 53rd Wing and ACC have not performed any detailed analysis on other plans, four have been identified as at least worthy of further consideration.[46]

The first course of action is our baseline, which is to retain the 53rd Wing's current inventory of 11 primary development and test aircraft at Eglin with ACC-owned maintenance. AFMC would continue to provide airfield management and air traffic control. This is the option priced above.

The second option would move Eglin aircraft to Edwards and Nellis, specifically the F-15C/D/Es to Nellis and the F-16s to Edwards. The remainder of the 53rd Wing, primarily the EWG, would stay at Eglin. This approach has the advantage of consolidating various aircraft types at the two other bases, thus avoiding additional maintenance manpower requirements at Eglin. There would be costs to relocate the aircraft, of course, as well as travel costs to return to Eglin for any testing required there. This option would also increase test activities at Nellis, which may affect training there. Additional study would be needed.

The third option moves the 53rd Wing headquarters and the majority of the 53rd Test Management Group to Nellis while leaving the EWG at Eglin. The Eglin aircraft would move to Edwards, thus keeping the close relationship between the 46th Test Wing and 53rd Wing intact. As with the previous option, there would be costs to relocate the aircraft, as well as travel costs to return to Eglin for testing there.

The final course of action mentioned is to move the 53rd Wing headquarters, the majority of 53rd Test Management Group, and the 85th Test and Evaluation Squadron to Nellis, while keeping the EWG at Eglin. This option would consolidate the 53rd Wing's aircraft at Nellis for operational test, creating economies of scale there. However, this option would also increase test activities at Nellis, which may affect training there. Additional study would be needed. As with the previous options, there would be costs to relocate the aircraft, as well as travel costs to return to Eglin for testing there.

It is outside the scope of this effort to attempt an evaluation of these three additional options, in terms of either cost or effectiveness. Given the high cost of keeping the 53rd Wing in place after the 46th Test Wing moves, if the AFMC plan appears to be moving forward, it is probably worth revisiting the subject with the 53rd Wing and going into more detail with wing staff members about their requirements and potential future needs.

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[46] USAFWC, 2006.

CHAPTER THREE

Ranges

Although a flight-test range is typically thought of as land area, airspace, and the associated test equipment, the Eglin "range" also includes important ground-test facilities. This chapter discusses the ranges involved in the AFMC proposal. It begins with the ground-based activities at Eglin, describing their functions and the potential cost and savings associated with their closure. It then turns to the potential cost effects of consolidating most open-air testing at Edwards and other nearby facilities.

The word *range* is used in a variety of ways in the Air Force, sometimes causing confusion. We use very specific definitions here. In this report, *open-air range* (OAR) refers to activities conducted to support open-air testing involving aircraft. It includes providing telemetry ground stations to receive data from aircraft and all other associated ground equipment, such as infrared and optical cameras; ground targets for both intelligence, surveillance, and reconnaissance testing and weapon testing; control rooms to run tests; safety equipment and management; and air traffic control. The term does not include aircraft crewing, maintenance, or other activities necessary to support sortie generation of either test aircraft or chase planes; these are the responsibilities of the test wing, not the OAR. The term also does not include the base operations necessary to support the range. Most important, it does not include activities that take place on the land that the range physically controls when these activities are not directly related to aircraft open-air testing. This monograph refers to these as *ground-based activities*.

This is a significant issue. Testing weapons and aircraft is inherently dangerous. Safety requirements dictate that, when necessary, testers have exclusive use of large areas of land and large volumes of airspace. Eglin and Edwards are, by land area, the two largest U.S. Air Force bases, at 724 and 470 mi^2, respectively. Access to such large areas is a key requirement for range operation, but, at any given time, the space is likely not to be in use. That makes these large facilities attractive locations for other relatively dangerous activities, such as ground testing of munitions. At Eglin, many of these activities are administered by the organization known as the 46th Test Wing Range Group and are staffed through the same contracting vehicle used to staff the OAR. The distinction this report makes between the OAR and ground-based activities is therefore purely functional. It does not reflect the way activities are organized or identify individual contractor employees.

Ground-Based Activities

The AFMC proposal does not explicitly list what is to be closed; however, Eglin's analysis indicates that the majority of these facilities will have to be closed to accomplish AFMC's proposed savings. Note that these facilities are distinct from those that are explicitly called out in the AFMC plan, such as the McKinley Climatic Laboratory. This section of the chapter discusses the functions of these miscellaneous facilities and the potential savings and costs that could result from closing them.

Description

As described to RAND by the 46th Test Wing, if facilities required to support flight-test operations at Eglin directly are excluded, the Eglin "range" includes the eight ground-test installations described in the following paragraphs.[1]

Base Installation Security Systems (BISS). Located at Eglin Test Site C-3, the BISS provides a dedicated test area for evaluation of security equipment and systems. The site covers 757 acres of cleared area on the Eglin range and simulates a section of a base perimeter and a secure area within a base or installation. The facility contains over 17,000 ft of security fencing, two 40-ft master surveillance and control facility (MSCF) towers, a security system facility building, and an entry control building with several types of entrance security systems designed for testing modifications and upgrades.

Gunnery and Ballistics Test Facilities (GBTF). The GBTF consists of four fully instrumented test areas or sites. These ranges are the Aeroballistics Test and Evaluation Facility (ATEF), located on Eglin Main Base; Test Area A-22, also located on Eglin Main; Test Area C-74L; and Test Area C-64. The gun ranges provide a capability to conduct gun and ammunition tests using high-explosive incendiary, armor-piercing incendiary, and target-practice ammunition. Typical calibers range from small arms up to 155-mm howitzers.

ATEF. The ATEF contains fixed, installed instrumentation systems used to measure and calculate the aeroballistic coefficients of supersonic shapes in flight. Fifty pairs of orthogonal film cameras and illumination sources are used to photograph the shapes during flight down the 230 meter facility.

A-22. This facility contains six gun bays and associated bullet traps to perform automatic and single-shot gun and ammunition tests using target-practice ammunition.

C-74L. This facility has two firing bays with associated target areas for testing high explosive incendiary rounds using single-fire and automatic gun systems.

C-64. This facility contains fixed firing positions, instrumentation, gun, calibration systems, and a vulnerability and lethality test area. The lethality test area consists of gun firing placements and associated target areas, warhead firing areas, and an 800-ft-long sled track. A radiation control area is included to accommodate firing of depleted uranium (DU) rounds.

HELLFIRE Test Facility (HTF). The HELLFIRE Test Facility is a unique network of remotely controlled instrumentation, data acquisition, and control systems used to support missile and other electro-optical (EO), infrared (IR), and laser-guided weapon testing. The HELLFIRE Test Facility consists of Test Area C-72, Test Site C-7, and Test Site C-7A.

Kinetic Energy Munitions Test Facility (KEMTF). KEMTF is located in Test Area C-74 and provides the capability to gather data on warhead effectiveness (up to 2,000 pounds net

[1] The following text is largely paraphrased from Dyess, 2007b.

explosive weight), fuse function, and weapon target interaction by accelerating a fully functional weapon to an operational delivery velocity along a 2,000-ft dual-rail track.

Operational and Functional Ground Test (OGT/FGT). This facility offers test customers a nondestructive, open-loop, operational test capability that simulates critical portions of a guided weapon's employment environment. The facility provides a ground test in which the guided weapon is "launched," its engine is started and running, and it is "flying" toward its target. During the free-flight and terminal portions of the flight, hardware-in-the-loop (HITL) simulations expose the item to EO/IR, visible, laser, and Global Positioning System (GPS) signals.

Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF). This facility provides the capability to collect high-fidelity target signatures that are critical for seeker and sensor development, guided weapon evaluation via simulated engagements, and live-fire target validation. The facility provides one-of-a-kind and state-of-the art instrumentation that includes the following:

- Staring IR Radiometric System (STIRRS)
- Airborne Staring IR Radiometric System (ABSTIRRS)
- Eglin Multi-Platform Imaging Radiometric System (EMPIRS)
- Calibrated IR Ground and Airborne Radiometric System (CIGARS)
- Airborne Spectral IR Measurement System (ASIMS)
- Spatial/Spectral Airborne Radiometric IR System (SARIS)
- Advanced Millimeter Wave Imaging Radar System (AMIRS): 10, 35, and 95 GHz
- Millimeter Wave Obscurant Characterization System (MROCS-2), operating at 10, 35, and 95 GHz
- Lynx: Ku-band synthetic aperture radar (SAR) on B-18
- Millimeter Wave Emitters, Radars, and Jamming System (MERAJS)
- Millimeter Wave Materials Measurement System (MMS)
- Directed Energy Weapon Simulator (DEWSIM), consisting of various high-power microwave devices.

Simulated Test Environment for Munitions (STEM). The STEM provides a wide range of performance testing under simulated, induced, and natural environments to test and determine that small munitions, mechanical and electronic assemblies and components, and related items are safe and that they will function as intended. Full rounds and component or subsystem items with a net explosive weight up to 10 lbs can be tested. The following chambers and systems support test methods contained in Military Standard 810: temperature-humidity-altitude chambers; temperature-vibration chambers; a thermal drying oven; a thermal shock chamber; an immersion chamber; a salt fog corrosion chamber; an explosion-proof testing chamber; a sand and dust chamber; a static ejection system; drop towers; a centrifugal accelerator; and jolt, jumble, and impact test machines.

Static Munitions Test Arenas (SMTA). The SMTA at the Test Area C-80 complex is used to test the lethality of conventional munitions, submunitions, gun ammunition, missile warheads, fuel air explosives, and insensitive explosives. Test Area C-80A has a total recovery fragmentation system for small munitions (under 8 lbs net explosive weight) and is the site for the OGT facility used to test full-up guided weapons up to 2,000 lbs net explosive weight. Test Area C-80B has a test area and control bunker for testing conventional munitions up to 500 lbs net explosive weight. Also at Test Area C-80B is the Gauntlet facility, which includes

a 220-ft tower for launching submunitions for effectiveness testing. Test Area C-80C is the main test arena and includes a test area and control bunker for conventional munitions up to 3,000 lbs net explosive weight.

Current Personnel and Funding

Although some of these ground-based test facilities are quite large, they do not enjoy the same budgetary and functional visibility as more prominent facilities, such as the McKinley Climatic Laboratory. To give a sense of their scale in personnel and dollars, Table 3.1 summarizes the budgetary categories used by the 2008 Program Objectives Memorandum and AFMC, employee numbers, and reimbursable budget authority (RBA) and direct budget authority (DBA) as budgeted for FY 2007.[2]

Several items in this summary table merit comment. First, all eight of these facilities are assigned to the Miscellaneous 46th Test Wing super–resource earning unit (super-REU) defined by AFMC.[3] This categorization will be important in the next section as we examine the AFMC-planned cuts. Second, the number of personnel assigned to each is difficult to define. Given the nature of these facilities, this is not hard to understand. Typically, these facilities are fully manned as necessary to support specific tests and are simply maintained during off

Table 3.1
Funding Summary of Miscellaneous Test Facilities

Facility	2008 Program Objective Memorandum (REU)	Personnel Assigned[a]	RBA Budgeted FY 2007 ($M)	DBA Budgeted FY 2007 ($M)
Base Installation Security Systems (BISS)	TE 3.10	48	3.9	1.7
Gunnery and Ballistics Test Facilities (GBTF)	TE 3.11	17	0.6	1.5
HELLFIRE Test Facility (HTF)	TE 3.12	10	0.3	0.8
Kinetic Energy Munitions Test Facility (KEMTF)	TE 3.8.2	9	0.5[b]	0.3[b]
Operational Ground Test and Functional Ground Test (OGT/FGT)	Not provided	5	0.3[c]	0.1[c]
Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF)	TE 3.9.2	34	0.3	2.3
Simulated Test Environment for Munitions (STEM)	TE 3.5	3	0.3	0.4
Static Munitions Test Arenas (SMTA)	TE 3.13	9	0.9	1.4
Total		135	7.1	8.5

SOURCE: 46 TW/XPR, 2007c, and Dyess, 2007g.

[a] These numbers do not include government operational personnel (test engineers and program engineers) or environmental, safety, logistics, or support personnel. The number of contractors is given as CMEs.

[b] FY 2007 budgeted numbers not provided, so FY 2008 used here.

[c] FY 2007 budgeted numbers not provided, so FY 2006 actuals used here.

[2] The RBA and DBA figures given here are FY 2006 actuals and do not include base operating costs (BOS). They do include facility sustainment and modernization costs when available.

[3] We are assuming here that the OGT/FGT facility is part of the "Miscellaneous 46th Test Wing" super-REU.

periods. The numbers given in the table above are simply the numbers necessary to operate the facilities fully. Some tests may require fewer personnel, who may only be needed for portions of a day. Finally, note that, overall, 54 percent of the total funding is direct (institutional) and 46 percent is reimbursable customer (program) dollars.

These issues are also highlighted when we examine the test utilization rates of the facilities. In fact, because these facilities are part of the Eglin range, their utilization data are not gathered directly but are instead gathered for the test areas in which they reside. In some cases, when there is a one-for-one correspondence between the two (such as the HELLFIRE Test Facility), this utilization may be fairly indicative of the use of the facility itself. However, it is still possible for the test area to be used for some type of test that does not actually make use of the "facility," i.e., the buildings and equipment listed in the previous section. With these caveats, Table 3.2 gives the average daily utilization of test areas and associated facilities for the period October 1, 2004, through June 1, 2006. The numbers given are the percentages of normal duty days scheduled by at least one activity. If more than one test by single organization (46th Test Wing, 53rd Wing, etc.) occurred on a single day, only one was counted. If, however, different organizations scheduled activities, the activities of all were counted. This is the primary cause of percentages higher than 100 and may cause a general overstating of utilization.

As can be seen, most of these facilities appear to be quite heavily scheduled, given the various caveats just discussed. As a result, closing them would be expected to have a large effect on current testing activities. However, the aforementioned caveats raise concern that utilization may be overstated. Since more-useful metrics, such as hours in use per day coupled with

Table 3.2
Estimated Utilization Rates of Miscellaneous Test Facilities

		Test Utilization (percent)		
Name	**Test Area**	**46th Test Wing**	**53rd Wing**	**Other**
Base Installation Security Systems (BISS)	C-3	100.0	1.4	1.0
Gunnery and Ballistics Test Facilities (GBTF)	A-22, C-64, and C-74L	143.5	1.4	1.9
HELLFIRE Test Facility (HTF)	C-72	88.2	1.9	1.0
	C-7, C-7A	41.1	1.9	0.0
Kinetic Energy Munitions Test Facility (KEMTF)	C-74	71.6	1.4	1.0
Operational/Functional Ground Test (OGT/FGT)	C-80A	See SMTA	See SMTA	See SMTA
Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF)	Not applicable	Not provided	Not provided	Not provided
Simulated Test Environment for Munitions (STEM)	Not provided	Not provided	Not provided	Not provided
Static Munitions Test Arenas (SMTA)	C-80A/B, C-80C, and C-80W	136.8	1.4	1.0

SOURCE: Dyess, 2007b.

personnel levels, simply do not appear to be available, it is difficult to determine whether these facilities are truly seeing the level of utilization the data indicate.

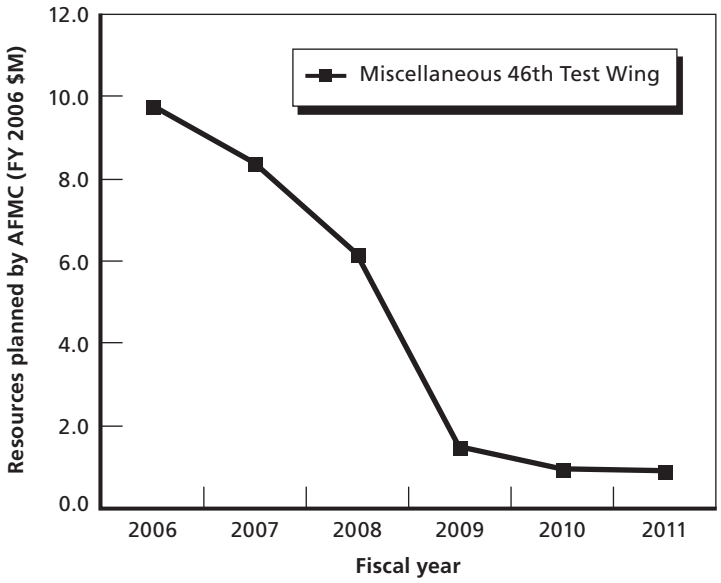
Effects of the AFMC Plan

Figure 3.1 gives the FY 2006 through 2011 DBA funding levels for the Miscellaneous 46th Test Wing super-REU, as specified in the AFMC plan. Note that much of the funding for these REUs comes from customer RBA sources, so the numbers given here do not reflect the actual dollars the super-REU requires to conduct testing.

Although these data do not provide the detail we need about our eight facilities, they do help scope the problem, in that the Miscellaneous 46th Test Wing super-REU is planned to have significantly lower resource levels. Recall that our eight remaining facilities belong to this REU. This super-REU was planned to move from $9.6 million in FY 2006 to $0.8 million in FY 2011.[4]

This planned cut in DBA (which is budgeted to be about 46 percent of the operating cost of the facilities in FY 2007) results in planned personnel cuts, focused on contractors.[5] Figure 3.2 shows the planned personnel levels for this Miscellaneous 46th Test Wing super-REU. As can be seen, there are cuts in all four categories, but the majority of cuts come in contractors—

Figure 3.1
AFMC Planned DBA Resources for Three "Super-REUs"

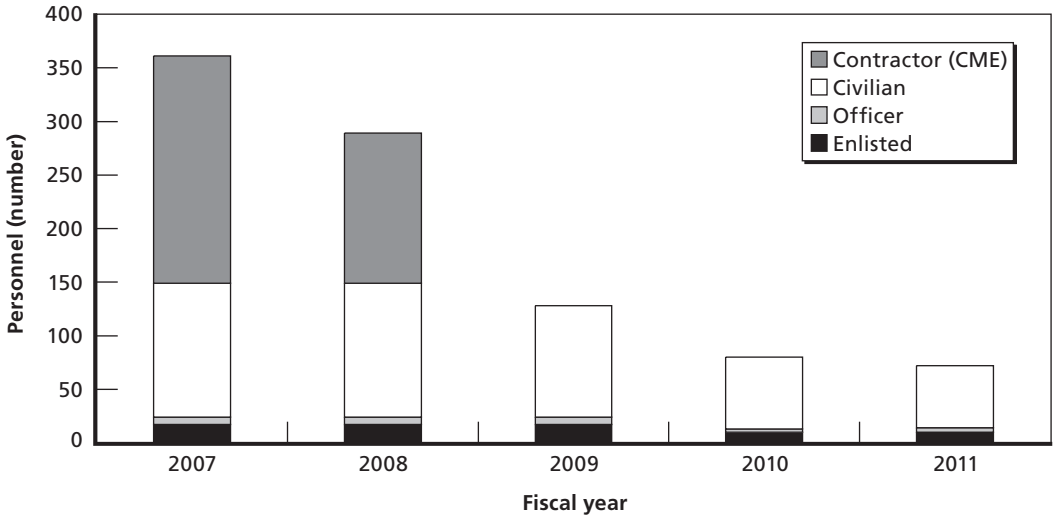


SOURCE: AFMC, 2007a.
NOTE: Excludes military pay and government civilians.
RAND *MG619-3.1*

[4] Note that the actual FY 2006 DBA total was $15.9 million. The figures used for the original AFMC plan appear to have underestimated the cost of this super-REU by a fairly large amount.

[5] Focusing on contractor cuts was part of the original PBD-720 mandate.

Figure 3.2
AFMC Planned Personnel Levels for Miscellaneous 46th Test Wing Super-REU



SOURCE: Dyess, 2007b.
RAND *MG619-3.2*

down to zero, as a matter of fact. The totals drop from 405 to 72.[6] Also, of this 405 total, only 135 are specifically assigned to our eight facilities (see Table 3.1). Hence, only about 40 percent of the planned 333 personnel cuts can be realized by closing the eight facilities in this super-REU. This also implies that cutting these facilities will generate only about 40 percent of the total super-REU savings.

The AFMC plan did not attempt to turn these dollar and personnel cuts into specific facility cuts for the Miscellaneous 46th Test Wing super-REU. However, the 46th Test Wing staff did do so and concluded that all eight facilities (BISS, GBTF, HTF, KEMTF, OGT/FGT, PSSSEF, STEM, and SMTA) would have to be closed. The other categories within the Miscellaneous 46th Test Wing super-REU are range support functions, such as vehicle operations, Link 16, OSS other than operations support, information technology management, core test-support elements, and safety. The personnel savings for these functions are discussed in Chapter Two as part of the 46th Test Wing staff reduction.

Cost Savings from Facility Closures

Since the AFMC plan did not break out savings between ground-test facilities and the other functions just discussed, it is difficult to use its cost numbers to estimate savings from closures. Furthermore, the plan used outdated budget numbers, which have since been revised. As a result, we make our own savings estimates using the FY 2007 budgeted personnel and other expenditures for each facility, as provided by the 46th Range Group.

It is important to clarify several assumptions about potential cost savings. First, we calculate the recurring and nonrecurring costs and savings over the FY 2007–2011 FYDP. The text in this chapter focuses on these costs and savings, which are the most important for current DoD programming decisions. As shown in Table C.1, we also calculate a 30-year NPV for

[6] Note that the actual FY 2006 total was 425. The figures used for the original AFMC plan appear to have slightly underestimated the personnel levels of this super-REU.

both savings and any additional costs, using a 3-percent discount rate.[7] This is the appropriate method of determining the overall utility of a particular course of action, particularly one with both recurring and nonrecurring effects that will stretch out far into the future.

There can be confusion about the correct approach to calculating savings from personnel cuts due to facility closures, primarily because of the split in funding between RBA and DBA dollars. One criticism of the AFMC approach was that the command calculated personnel losses that result from cuts to DBA funding only. Since personnel are funded by both DBA and RBA, this approach underestimates either the savings realized from dismissing personnel or the necessary number of discharged personnel to realize the desired savings, depending on one's perspective. Furthermore, this approach does not capture savings in RBA that might also be realized (typically by the testing programs) through efficiency gains. However, a focus only on DBA is appropriate if the goal is to determine what AFMC can do, by itself, to service the desired PBD-720 cuts.

Our solution to this issue is straightforward. We will simply track changes in the overall governmental payroll and, for the most part, ignore the details of the DBA-RBA split.[8] RAND's analysis takes this perspective because the primary consideration for cost-effectiveness should be whether it generates savings for DoD as a whole, rather than solely for AFMC. Simply moving costs from AFMC to ACC, acquisition programs, or the Navy will not offer any real benefit to the government or taxpayers. Thus, the results reported here are not relevant to what AFMC can do to service its share of the PBD-720 wedge and should not be interpreted in such a light. They take a DoD-wide perspective, not an AFMC- or Air Force–only perspective.

With this in mind, cost savings from facility closures or reductions can come from three sources. First and most important, because of the size of the possible savings, are the savings that result from reducing military personnel, government civilian, or contractor staffs. The 46th Test Wing provided RAND a budgeted FY 2007 workforce count for each facility, which we used to calculate reductions and hence the cost savings.[9] For transparency and simplicity, we assumed that each facility would close in FY 2009 (to correspond with the date of the 46th Test Wing move and other range reductions), used the FY 2007 Total Annual Average Standard Composite Rates from AFI 65-503 for military enlisted and officers, and used $100,000 per year as the total cost to the government for civilians and contractors.[10] Although some facilities may use a mix of more- or less-expensive personnel, these rates should, in the aggregate, reasonably reflect costs and allow us to avoid determining the exact skill level and pay scale of every employee.[11]

The second possible source of cost savings would be avoiding planned sustainment and modernization costs for a shuttered facility. The 46th Test Wing provided budgeted sustain-

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[7] We are following the procedures laid out in Office of Management and Budget (OMB) Circular A-94, which guides U.S. government cost-benefit and cost-effectiveness analyses.

[8] In fact, if DBA and RBA dollars are fully tracked and accounted for from the initial cut to their eventual destination, the costs and savings calculated would produce results identical to those shown here.

[9] Dyess, 2007g.

[10] This rate is corrected to $90,800 for civilians and contractors at Eglin AFB and China Lake as per Office of Personnel Management (OPM) locality pay adjustments. This agrees fairly well with the average civilian pay rate of $96,852 provided by 46 TW/XPR.

[11] For contractors in particular, this may be difficult or impossible to determine.

ment and modernization costs for each facility, although, for the most part, no costs were present in these categories.

The final source of savings could be reducing BOS costs. We would expect that the 46th Test Wing pays the host base at a rate proportional to the size of its presence and, hence, that this cost would decline as its personnel levels drop. However, unlike other MRTFBs, such as the AFFTC or AEDC, we have not been able to locate any data about BOS costs for the Air Armament Center and so are unable to capture these possible savings.

Potential Additional Costs

Of course, closing these facilities will not only produce savings but also incur costs. These additional costs include, at a minimum, the following:

- closure costs, such as environmental cleanup and disposal
- the additional costs and risks for each testing program that must change test schedules; locations; and, possibly, type of testing
- the cost to upgrade the capacity and capability of alternative facilities, if necessary.

We also include one-time penalties of 20 percent of salary for each employee terminated at a closed facility (to account for various costs, such as contract-termination fees) and 50 percent of salary for each new employee hired at an alternative location (for recruitment costs, for instance).

If the Air Force ceases funding the eight facilities the 46th Test Wing specified in response to the AFMC cuts, changes will be necessary in the testing plans of the affected programs. There are five obvious ways for programs to accommodate these closures, arranged here roughly in order of increasing short-term cost:

1. Do not perform the testing.
2. Perform the tests at another existing facility or facilities that can support the testing without modification or upgrade.
3. Modify or upgrade an existing facility or facilities so that they can perform the tests.
4. Allow a different entity (the program itself, another service, or a private venture) to take over operation of the current facility.
5. Rebuild or otherwise recreate the closed facility in a new location.

Determining the least expensive of these five options is not easy. For instance, option 1, avoiding testing, may reduce costs for a program in the short term but increase them later, when undiscovered technical problems emerge. Because evaluating this option would require detailed knowledge of each program's requirements, we generally avoid this approach and simply assume that the amount of testing will remain constant. Options 2 and 3 will be the most common approaches, although option 4, which could appear expensive from the program's viewpoint, may actually be cost-neutral from an Air Force or DoD-wide perspective. It is difficult to imagine option 5 being preferred in any circumstance unless the new, rebuilt facility has much lower operating costs than, yet similar capabilities and capacity to, the previous one. In general, the "optimum" solution will vary by facility and could vary by program using each facility. Conceivably, the cost effects for each program using each facility could be

tallied then summed for every option, although this would be an enormous undertaking and is beyond the scope of the present study.[12]

Facility Closure Net Costs or Savings

To show how we calculate the DoD-wide effects of the AFMC plan, we first discuss the effects of a facility closure or reduction and a recommended strategy programs can use to manage their testing needs cost-effectively. We lay out, in a simple fashion, all the savings and costs we have identified and highlight missing data. In these cases, we either examine a parametric range of values or make the most conservative estimate possible (favoring the status quo). We conclude with a summary of the quantitative findings and a discussion of their implications.

In the following analysis, all the current facility staffing levels, sustainment and modernization costs, and closing costs were provided by the 46th Test Wing and were used without independent confirmation. No RAND-generated cost estimates are used. As discussed above, staffing levels were converted to costs using standardized government pay rates. For computing savings, facilities were assumed to close in FY 2009 and thus save annual personnel and sustainment costs from that point on, minus the nonrecurring closing cost. When available, the costs of upgrading and operating an alternative facility were provided by NAVAIR. These costs were also used without independent verification, although qualitative comments on their validity were provided by the 46th Test Wing and are noted below. For these facilities, few data were available on the extra costs programs might entail by testing at a new location instead of the closed Eglin facility. When available, such data were provided by an Air Armament Center analysis and are noted as such.

Base Installation Security Systems. This facility covers over 750 acres and includes several large buildings and towers; two 8,000-ft runways; and a large number of security sensors and supporting infrastructure. Obviously, such a large facility cannot be relocated easily. One analysis put the cost of recreating the BISS at a new location as between $30 million and 50 million.[13] The 46th Test Wing estimates of mothball costs are $2.4 million initially and $4.8 million to restart. Total shutdown would reportedly cost approximately $3 million, but result in the cost savings for 48 contractors.[14] The Air Armament Command collected data from user programs on their additional expenditures if this facility were to close, which totaled $50 million in nonrecurring costs. This figure turned out to be the cost of entirely recreating the BISS at a new location.[15]

If the BISS were simply closed, as per the AFMC plan, we calculated the following costs and savings, in FY 2007 dollars:

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 48

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[12] The Air Armament Center actually did attempt a similar effort at the request of SAF/AQ. We will refer to some of their results in this section. For the full report, see AAC, 2006.

[13] 46 OG/CA, 2007.

[14] Dyess, 2007b.

[15] 46 OG/CA, 2007.

- total personnel cost savings: $4.36 million per year minus $871,680 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $3.04 million
- additional costs to programs: $50 million, nonrecurring
- upgrade costs to alternative sites: unknown
- modernization costs avoided: $0
- sustainment costs avoided: $14,009 per year.

Using these figures, if the BISS were simply closed in 2009, $9.2 million would be saved for the FY 2007–2011 FYDP.[16] This result is obtained via the following calculation:

$$3 \text{ years} \times (4.36 + 0.014) - (3.04 + 0.87) = \$9.2 \text{ million}.$$

Recall that the AAC-provided additional program cost was $50 million, wiping out any savings over the FYDP. However, closing a facility only to recreate it in a new location is obviously never going to be a cost-effectiveness option. Presumably, the recreated facility will have operating costs similar to those of the original; hence, the nonrecurring cost will never be recouped.

Rather than simply closing the facility, however, or closing it and recreating the capability elsewhere, the most logical choice, if it must be removed from AFMC funding, is simply for the users to take over funding of the facility. Unlike many other test facilities, comparatively few programs (the Air Force Security Forces Center, AFOTEC, and 642nd Electronic Systems Squadron/Force Protection) use the BISS; hence, funding could be transferred efficiently, with little disruption to other users. Such an effort is already reportedly under way for the BISS with Electronic Systems Command (ESC). Although this option would reduce AFMC costs by $1.7 million (FY 2007 budgeted DBA), there would be no overall Air Force or DoD savings because the costs are simply shifting to the programs.[17] This may not satisfy the intention of the PBD-720 cuts.

There are, of course, possible downsides to this approach. Deconfliction with other range users could be an issue and would require close coordination among the facility users and the range organizations. Although simply having the users take over the facility appears to be a viable option, the programs may find the cost burden too great, and cost transfers from AFMC may be programmatically impossible. If this is the case, the remaining solution is to move testing to alternative locations. Most BISS capabilities are not particularly unique and could be implemented at other existing locations, although most likely not at a single site. For instance, several of the national laboratories have programs that test security measures for nuclear facilities. As just mentioned, however, no cost analysis has been performed for this option, and additional research is needed to quantify exactly what work would be necessary to upgrade other facilities. Further, additional program costs, such as travel expenses, would need to be determined.

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[16] Our calculations over the FY 2007–2011 FYDP do not include a discount rate and are in constant FY 2007 dollars. They are presented here merely for convenience in comparison with other analyses. In general, the net present value calculations are a much more accurate measure of the long-term cost or savings of a particular action.

[17] 46 TW/XPR, 2007c.

We can examine this somewhat parametrically by determining the maximum annual cost all programs together would be willing to pay over the FYDP and still have a net savings for closure. For the BISS, if we calculate what additional annual cost would produce zero savings over the FYDP this comes to $3.1 million per year. This figure is calculated with the following formula:

$$\$9.2 \text{ million savings} \div 3 \text{ years} = \$3.1 \text{ million per year.}$$

Compared to the $3.9 million the programs are already paying (FY 2007 budgeted RBA), this indicates that alternative facility and additional program costs could be quite large (almost twice the current costs) yet still make it cost-effective to close the BISS.

Gunnery and Ballistics Test Facilities (GBTF). This facility includes several instrumented aircraft firing ramps, gun ranges, and stands and permits the use of DU rounds. Test tracks, drop towers, temperature-conditioning equipment, and mobile test facilities are also available. ATEF provides the capability to image flying projectiles in a 230-m underground facility. Several dozen programs use GBTF, primarily for investigating malfunctions and conducting ammunition acceptance and sustainment tests.

Such options as simply stopping this type of testing or having the programs themselves take over the facility appear to be problematic. Gun and ammunition systems can require regular testing for acceptance and sustainment, and operational failures put lives at risk and are difficult to resolve. Because so many different programs use these facilities, coordination and cost-sharing would be quite complicated.

If testing is to continue, several possible alternatives to this facility have been identified, including Hill AFB, Utah, and the Utah Test and Training Range; the Yuma Proving Ground, Arizona; Picatinny Arsenal, New Jersey; and NAWC China Lake, California. Of these, however, only the Yuma Proving Ground has the ability to test DU rounds, and most of the others are limited in the sizes of rounds they can test. The most detailed analysis was carried out by NAVAIR to examine non-DU testing at China Lake. Its conclusion was that the GBTF testing could be accommodated by adding magazine storage space (approximately a $350,000 investment) and hiring four people ($363,000 per year). However, this analysis reportedly ignored some GBTF capabilities (such as shaped-charge jet characterization, explosively forged penetrator characterization, and gun-launched simulants) and neglected to include the costs of transporting some equipment from Eglin to China Lake.[18] If this is correct, the missing capabilities could likely be generated at the other facilities with additional investment, although no cost analysis has been performed. A closer look should also include an examination of whether all testing conditions (such as tropical weather) can be met at the other locations. Another factor is a BRAC 2005 recommendation that China Lake move all ammunition testing to the U.S. Army Picatinny Arsenal, thus making them unavailable to take on GBTF workload. AAC did not provide additional program costs specifically for this facility.

We calculated the following GBTF-related costs and savings, in FY 2007 dollars, if the GBTF were closed and the testing moved to China Lake:

[18] Dyess, 2007c.

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 17
- total personnel savings: $1.54 million per year minus $308,720 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $18.62 million
- additional costs to programs: unknown
- upgrade costs to alternative sites: $341,802 investment plus $363,200 per year plus $181,600 in hiring fees
- modernization costs avoided: $0
- sustainment costs avoided: $4,009 per year.

Given these inputs, simply closing the facility and moving the testing to China Lake results in an overall cost of $15.9 million (although Appendix B shows a savings over a longer time period). This is calculated as follows:

$$3 \times (1.54 + 0.004) - 3 \times 0.363 - (0.308 + 18.62 + 0.342 + 0.182) = -\$15.9 \text{ million.}$$

This is because the large $18.62 million closure cost (primarily for DU cleanup) outweighs the annual savings of around $1 million per year.[19] Also, no analysis has been performed to determine additional costs that individual programs might incur by testing at China Lake (such as travel) or by delays waiting for the additional capacity to come on line. These additional costs will only increase the negative outcome.

A large unknown here is the location and extent of DU testing. The Yuma Proving Ground appears to be the only other DoD facility with a permit to test DU rounds. Since gaining permission for DU testing is likely to be a long, involved process, one mechanism to facilitate the closure of this facility is to move the non-DU testing to other facilities and simply cease Air Force testing (and hence use) of DU ammunition. The only current user is the 30-mm cannon on the A-10 aircraft, for which the DU rounds provide excellent capability for penetrating armored vehicles. However, wartime use of this type of ammunition has become less frequent because of the criticism the United States has received over possible health risks. This issue is obviously outside the scope of this study but will require additional analysis to examine the cost and effectiveness trade-offs for this type of testing.

HELLFIRE Test Facility (HTF). The HTF focuses on Army and Air Force guided-missile testing and includes significant instrumentation and target facilities, as well as such infrastructure as a hangar and missile launchers.

As with the BISS, the HTF is a substantial facility that would be expensive to relocate but supports only a few users, primarily the Army HELLFIRE, Apache Longbow, and Joint Common Missile programs with developmental work for Advanced Precision Kill Weapon System and Compact Kinetic-Energy Missile. AAC provided additional program costs for four Army programs using the HTF: HELLFIRE II, Laser HELLFIRE, Longbow HELLFIRE,

[19] Dyess, 2007b.

and Joint Common Missile. For the three years following closure (2009–2011), these programs projected additional costs of $5.12 million, although $5 million of those costs were simply to rebuild the HTF in a new location.

We calculated the following HTF-related costs and savings if the HTF were closed, in FY 2007 dollars:

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 10
- total personnel savings: $908,000 per year minus $181,600 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $506,052
- additional costs to programs: $5.12 million over the FYDP
- upgrade costs to alternative sites: unknown
- modernization costs avoided: $0
- sustainment costs avoided: $1,877 per year.

Without including the additional program costs, the savings for simply closing the facility total $2.0 million over the FYDP. If we include the cost to programs of $5.12 million, there is a net cost of $2.9 million over the FYDP. If these additional program costs are realistic, it would not appear cost-effective to close the HTF. However, closing a facility only to recreate it in a new location is obviously never going to be cost-effective. Presumably, the recreated facility will have operating costs similar to those of the original; hence, the nonrecurring cost will never be recouped.

As a result, and as with the BISS, a sensible option for this facility, if it must be removed from AFMC funding, is for the users to take over funding from Eglin AFB and AFMC. As with the BISS, however, transferring ownership of the facility would save AFMC costs but only by transferring them to another DoD entity—in this case, the Army. It is not clear that this would satisfy the intention of the PBD-720 cuts. Although this approach has potential disadvantages, such as the need for deconfliction with other range users and the requirement for the programs to take over $804,000 in costs (FY 2007 budgeted DBA), these issues should dwarf the expense and disruption of moving all testing to a new location or closing and recreating the entire facility. The programs would need to estimate and budget for periodic repair and upgrade costs, as well as the cost of support staff, such as environmental, safety, and logistics personnel. Additional research would be necessary to quantify these costs and evaluate whether current programmatic resources would be sufficient. In terms of cost accounting, however, the effect should be small because our projected savings also do not include their effects.

Kinetic Energy Munitions Test Facility (KEMTF). The KEMTF is oriented around a 2,000-ft sled track with associated support facilities, such as targets, pre- and post-test instrumentation, cranes, and warhead temperature-conditioning equipment. A large number of munitions programs use the facility because it commonly uses the sled track to test live rounds. This is reportedly because sled-track repairs cost less here than at other sled facilities and because live munitions can be destructively and nondestructively inspected here after a test. Facilities such

as the 4-mi-long Supersonic Naval Ordnance Research Track (G-4 track) at China Lake do test live rounds as well, however.

The KEMTF is not a prime candidate for simple transfer to program or other service management because so many testers utilize the facility. The primary option of interest here would be to use other, similar facilities. Alternative sled tracks are available, including the G-4 track at China Lake and the 10-mi-long High Speed Test Track at Holloman AFB. However, both tracks provide speeds well beyond those necessary for typical KEMTF tests and reportedly would be quite expensive to repair after live-fire tests.[20] NAVAIR analyzed the sled-track facilities at China Lake and concluded that it would be necessary to invest approximately $800,000 (and 12 to 15 months for construction) in improvements, add eight staff members (at an annual cost of around $800,000), and budget an additional $120,000 per year for maintenance to accommodate the Eglin KEMTF tests.[21] More research would be necessary to confirm these costs and ensure that all needed equipment was available. AAC did not provide additional program costs specifically for this facility.

We calculated the following KEMTF-related costs and savings if the KEMTF were closed and testing moved to China Lake, in FY 2007 dollars:

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 9
- total personnel savings: $817,000 per year minus $163,440 in termination fees
- BOS savings: not provided
- closure and cleanup costs: not provided
- additional costs to programs: unknown
- upgrade costs to alternative sites: $828,609 investment plus $846,400 per year plus $363,000 in recruiting fees
- modernization costs avoided: $0
- sustainment costs avoided: $2,970 per year.

Using these inputs results in a small loss of $1.4 million over the FYDP. Recall, however, that we have not been provided KEMTF closure costs or additional program costs, so the actual cost would be higher. This facility would not appear cost-effective to close.

Operational/Functional Ground Test (OGT/FGT). This facility is used to simulate an entire aircraft sortie to exercise the weapon's temperature, rain, icing, and vibration resistance and its seeker performance during the free-flight and terminal phases. Only five personnel staff this facility, and the calculated closure cost is approximately $500,000.[22] AAC did not provide additional program costs specifically for this facility.

We calculated the following OGT/FGT closure costs and savings, in FY 2007 dollars:

[20] Dyess, 2007b.

[21] Dyess, 2007c.

[22] Dyess, 2007b.

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 5
- total personnel savings: $454,000 per year minus $90,800 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $506,052
- additional costs to programs: unknown
- upgrade costs to alternative sites: unknown
- modernization costs avoided: $0
- sustainment costs avoided: $0.

As with many of the other facilities, no analyses of substitute locations or additional program costs were provided to RAND for this facility. We therefore calculate a savings of $770,000 over the FYDP. The NAVAIR analysis concluded that the Navy had no capability to replace the OGT/FGT facility. If we again compute the maximum annual program cost increase that produces zero savings, the result is $256,667 per year ($770,000 divided by 3 years). Given that there are no obvious alternatives and that additional costs of this magnitude may not be difficult to realize, closing this facility is unlikely to be cost-effective.

Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF). The PSSSEF is an unusual "facility" in that it is actually a set of fairly disparate capabilities. First, there is a large variety of EO, IR, and RF signature-measurement systems, both airborne and ground-based. Second, there is the Eglin Mobile Missile Launcher System (EMMLS), which provides live launch capabilities for man-portable air-defense systems (MANPADS) against real or simulated aircraft.

The unique feature of the PSSSEF is that it concentrates signature measurement capabilities in one location and can operate in similar environments against the same targets. Other locations, such as Point Mugu and Patuxent River, have some elements of this signature-measurement capability, but not at all wavelengths and not against all target types. On the other hand, the name of the facility itself indicates that much of it could be relocated to other test locations. The primary issue could be the availability of a diverse set of target types and environmental and background environments. Eglin estimates that complete shutdown of this facility would cost approximately $1.2 million, although the cost breakdown has not been provided.[23] AAC did not provide additional program costs specifically for this facility, and NAVAIR did not analyze possible alternatives.

We calculated the following costs and savings if the PSSSEF were closed, in FY 2007 dollars:

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 34
  - contractors: 0

[23] Dyess, 2007b.

- total personnel savings: $3.09 million per year minus $617,440 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $1.22 million
- additional costs to programs: unknown
- upgrade costs to alternative sites: unknown
- modernization costs avoided: approximately $36,676 per year
- sustainment costs avoided: approximately $119,497 per year.

With these savings and costs, simply closing the PSSSEF gives $7.9 million in savings over the FYDP. However, the lack of data on alternative upgrades or additional program costs will affect this result. The calculated maximum total program cost per year that would offset these savings is $2.6 million per year compared to the current RBA of $318,000 (FY 2007 budget). More analysis is needed to address these issues, but given that most of the PSSSEF capabilities exist in other facilities and if the capacity exists to accommodate Eglin testing, it may very well be cost-effective to close the PSSSEF.

Simulated Test Environment for Munitions (STEM). STEM is a set of testing facilities for subjecting munitions to realistic environmental conditions, such as temperature and vibration. It also includes noninvasive test instrumentation, such as X-ray and fluoroscope, for examining test articles.

As with some of the other facilities, STEM serves a wide variety of customers and so would not be easy for a single user to take over. However, its capabilities are not particularly unusual and could be undertaken at several alternative locations, most likely with some moderate upgrades required. NAVAIR conducted an analysis of STEM activities and concluded that all the STEM work could be accommodated at existing facilities at China Lake with the addition of one technician and $30,000 per year additional maintenance.[24] Eglin estimates that complete shutdown of the STEM would cost $650,000.[25] AAC did not provide additional program costs specifically for this facility.

We calculated the following STEM-related costs and savings, in FY 2007 dollars, if the STEM were to be closed and testing performed at China Lake:

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 3
- total personnel savings: $272,400 per year minus $54,480 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $657,868
- additional costs to programs: unknown
- upgrade costs to alternative sites: $120,800 per year plus $45,400 in recruitment fees
- modernization costs avoided: $0
- sustainment costs avoided: $1,270.

[24] Knight and Taylor, 2007.

[25] Dyess, 2007b.

The calculation with these inputs gives a small cost of $300,000 over the FYDP (although Table C.1 shows a savings over a longer period). No additional program costs have been included in this calculation, so the actual loss would likely be greater.

Static Munitions Test Arenas (SMTA). The SMTA primarily consists of several cleared range areas equipped for explosive munitions testing up to 3,000 lbs net explosive weight. Each area has instrumentation for evaluating blast and fragmentation effects, as well as such assorted capabilities as drop towers, bunkers, control rooms, and temperature conditioning chambers. Little is unique here, although the facilities are quite large and could not be moved easily. Eglin has estimated the cost for closing this facility to be around $100,000.[26] NAVAIR conducted an analysis of SMTA activities and concluded that the facilities at China Lake could accommodate 100 percent of the tests and that the staff could support 80 percent of them. Since no cost estimate was provided for this last 20 percent of capacity, we have simply added 20 percent of Eglin's current personnel cost to the alternative facility as a first-order estimate of additional annual cost. No estimates for additional program costs were available.

We calculated the following for SMTA closure with testing moved to China Lake, in FY 2007 dollars:

- personnel decreases
  - enlisted: 0
  - officers: 0
  - government civilians: 0
  - contractors: 9
- total personnel savings: $817,200 per year minus $163,440 in termination fees
- BOS savings: not provided
- closure and cleanup costs: $111,332
- additional costs to programs: unknown
- upgrade costs to alternative sites: $163,440 per year plus $81,720 in recruitment fees
- modernization costs avoided: $0
- sustainment costs avoided: $12,505.

As would be expected with relatively large savings and small additional costs, we obtain a savings of $1.6 million over the FYDP. Although there were no data on additional program costs, the maximum additional cost to offset the savings is $533,000, compared to the current RBA of $900,000 (FY 2007 budgeted). More-detailed research would be necessary to determine how likely programs would be to accrue this additional cost, but because of this relatively high allowable additional cost, there is a reasonable likelihood that it would be cost-effective to close this facility.

Summary of Results

Table 3.3 summarizes the results of the previous discussion. Because of the many uncertainties involved, we do not attempt to produce a total cost or savings for the entire set of facility closures. In general, there is no compelling reason to treat all these facilities as an indivisible whole; different cost-effective outcomes can be found for each.

[26] Dyess, 2007b.

Table 3.3
Costs and Savings Calculations for Proposed Facility Closures (FY 2007 $M)

	Nonrecurring Costs	Annual Costs	Nonrecurring Savings	Annual Savings	Total Savings Over FY 2007–2011 FYDP
Base Installation Security Systems (BISS)	3.91	0.00	0	4.37	9.2
Gunnery and Ballistics Test Facilities (GBTF)	19.45	0.36	0	1.55	(15.9)
HELLFIRE Test Facility (HTF)	0.69	0.00	0	0.91	2.0
Kinetic Energy Munitions Test Facility (KEMTF)	1.36	0.85	0	0.82	(1.4)
Operational/Functional Ground Test (OGT/FGT)	0.60	0.00	0	0.45	0.77
Portable Seeker / Sensor / Signature Evaluation Facility (PSSSEF)	1.84	0.00	0	3.24	7.9
Simulated Test Environment for Munitions (STEM)	0.76	0.12	0	0.27	(0.3)
Static Munitions Test Arenas (SMTA)	0.36	0.16	0	0.82	1.6

Of the above facilities, AAC provided specific additional program costs for only two: the BISS, at $50 million nonrecurring, and the HTF, at $5.12 million over the FYDP. These estimates are simply for recreating the facilities and so are not particularly informative as an estimate of additional costs to users. Although we do not have specific program costs for the other facilities, we do have a total for programs that use ground test facilities. This can be compared to the total cost or savings if these facilities were closed, as shown in Table 3.3. The AAC estimate of three years of costs (2009, 2010, and 2011) following closure is $85.44 million. If we subtract the already considered BISS and HTF facilities, the additional costs total $30.32 million ($18.29 million of the total is for two programs: Large Aircraft Infrared Countermeasures and Other Infrared Countermeasures). From Table 3.3, the total for the remaining six facilities is a cost, not a savings, of $7.37 million. With the additional program costs of $30.32 million, the total cost of closing all six facilities would then total $37.69 million. This is clearly not a cost-effective option. Note, however, that this does not preclude the cost-effectiveness of selected facility closures. Individual savings may be large enough and additional program costs small enough to result in a cost-effective closure despite this aggregate result.

In summary, closing BISS could produce good returns, but the results are misleading because of the lack of data on the costs of equipping alternatives and on possible additional costs to testers. More analysis is necessary. Transferring all costs to the limited number of test program users, as is already under way, is the most likely solution for reducing AFMC costs, but the overall cost to DoD would remain unchanged. Even if DoD did obtain a cost benefit, AFMC is simply shifting costs to other parties. When this occurs, it shifts a portion of the burden of its share of the wedge created by PBD-720.

Closing PSSSEF and SMTA would likely produce a cost benefit to both AFMC and DoD.

Closing GBTF, KEMTF, HTF, OGT/FGT, or STEM would offer little or no cost benefit, even with current cost and savings estimates. The HTF may be another good candidate

for single-user status with its U.S. Army users, although this would simply transfer costs and not result in savings to DoD as a whole.

Consolidation of Open-Air Test Ranges

Aircraft-related open-air testing consists of a wide range of activities. It includes relatively undemanding tests, such as those performed with aircraft stationary on the ramp. It also includes demanding testing with serious safety concerns, such as live-fire tests of low-range munitions. Many types of open-air testing take place daily at Air Force installations around the world. However, many types of tests are best performed on a dedicated range equipped with appropriate instrumentation and with control of large amounts of land and airspace. The U.S. Air Force currently operates two major facilities of this type, at Eglin AFB and Edwards AFB.

This section examines the potential cost effects of consolidating most open-air testing at Edwards and other nearby facilities, collectively known as the WTR. Such a consolidation would greatly reduce the level of open-air test activity at Eglin. We are concerned here with costs associated with what we call the "range."

Definitions

The terms *capability* and *capacity* are frequently used in discussing the ability of an OAR to conduct operations. While we will use these terms as the OAR community commonly uses them, it is important to be explicit about what they mean.

In this context, *capability* refers to the physical capability of a facility, what it can do with the land, equipment, etc., available. For example, Edwards itself does not have the capability to conduct sea-level testing. Eglin does not have the capability to conduct attacks on targets buried in mountainsides. Restrictions on capability are relatively difficult to mitigate.

Capacity refers to the volume of work that a range can perform at a given level of staffing (and therefore of funding). Ranges generally operate at full capacity because they are well managed. They are not overstaffed, so if the workload were to increase substantially, new people would have to be hired or existing staff would have to work longer hours. Historically, capacities at both Eglin and Edwards have varied with national requirements. Note that this is different from the definition of capacity used in the BRAC process. The BRAC analysis defined capacity by looking at historic activity levels. For example, because Edwards activity had been higher in the recent past, the BRAC process concluded that Edwards had excess capacity.

Research Approach

We have not independently assessed Air Force requirements for open-air testing. Instead, we have assumed that the current level of activity at Edwards and Eglin AFBs is effectively the Air Force's requirement. We have assumed that any reduction in capacity at Eglin must therefore be offset with an equal enhancement in capacity at the WTR or elsewhere.

The core of this effort is to provide an independent high-level view of the probable cost effect of transferring the 46th Test Wing's open-air munitions testing workload to the WTR and other facilities. This cost effect includes the direct costs that units in the WTR would incur, as well as indirect costs affected programs would incur. As elsewhere, the term *cost* refers to the total cost to the U.S. taxpayer, not the cost in any particular budget category. That is, we have not treated program costs and institutional costs separately. There may be legitimate

differences of opinion about how these costs would be ultimately apportioned. Our study does not address that issue.

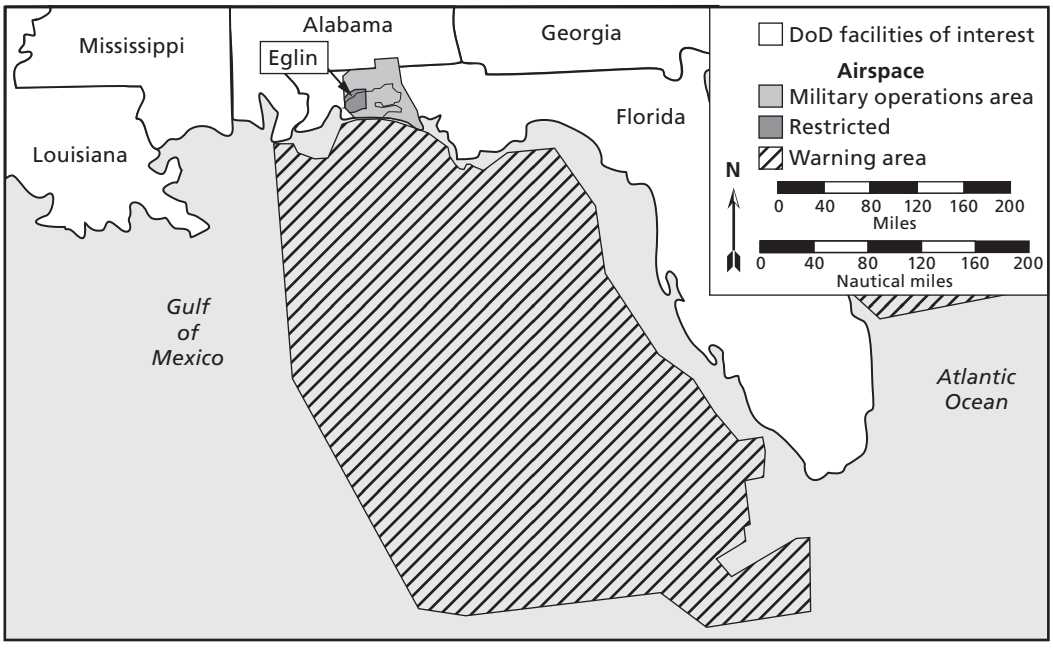
We consulted with many organizations involved in range operations, especially the range group at Eglin AFB, the range squadron at Edwards AFB, and the Navy's range organizations at Point Mugu and China Lake, both part of Naval Air Warfare Center Weapons Division (NAWCWD). All these organizations were extremely helpful, providing us with extensive documentation and access to their facilities and personnel.

Range Background

Eglin Range Complex (Eglin AFB). The Eglin range is located in the panhandle of Florida and in the adjacent Gulf of Mexico (Figure 3.3). Eglin's over-water range (called the Eglin Gulf Test and Training Range) provides more than 98,000 mi^2 of over-water airspace that is jointly used for a variety of T&E activities and training exercises. The over-water range contains several test areas that are used for long-range, all-altitude, air-to-air activities, including drone target engagements, electronic combat, and long-range (or antiship) air-to-surface and surface-to-surface evaluations.[27] The over-water airspace is complemented by the over-land airspace, providing interaction between water and land test ranges.

Land and airborne radar systems, as well as EO time-space-position-information systems, are used to monitor operations in the range area. The test wing at Eglin AFB is developing an over-the-water scoring system for bombs, air-to-surface missiles, and aircraft guns.[28]

Figure 3.3
Eglin AFB and Associated Airspace



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[27] Global Security, 2007a.

[28] Global Security, 2007a.

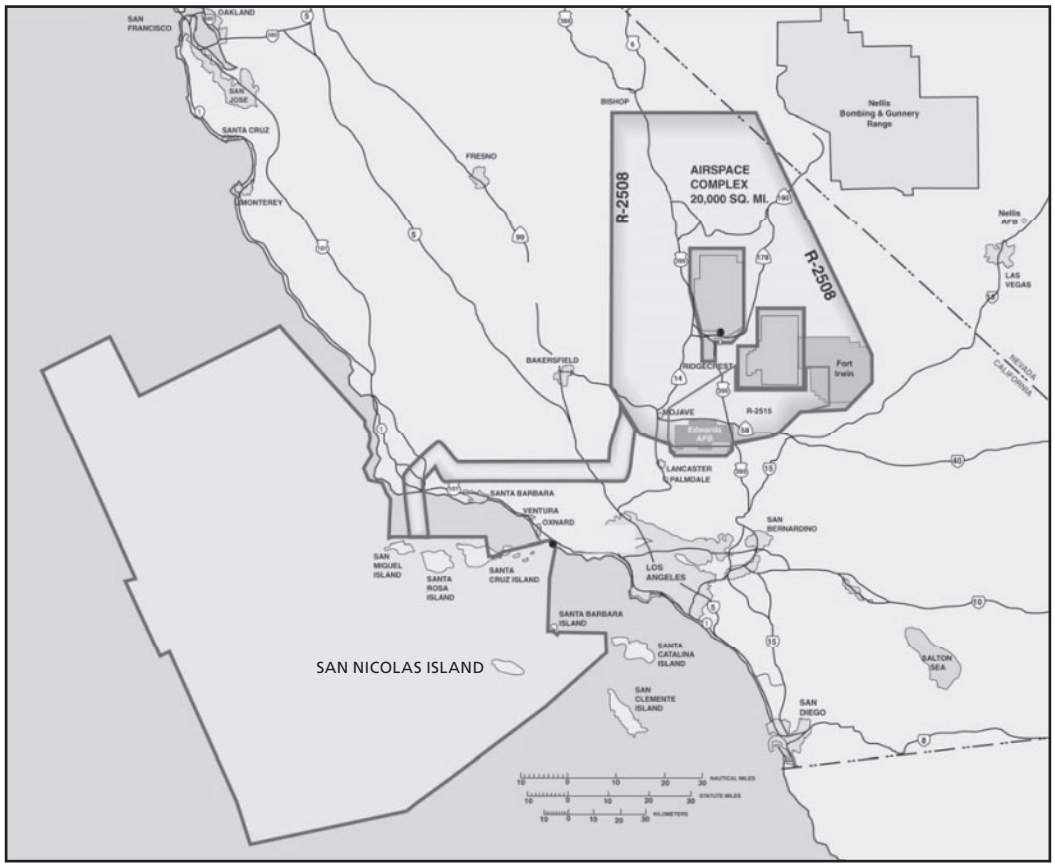
Eglin maintains several warning areas in the over-water range, as well as restricted areas at the over-land range. Short- and medium-range missile testing occurs in one of the warning areas, including operational T&E of these missile systems against drones launched from Tyndall AFB, Florida. Other T&E activities occurring over water include aircraft and munitions systems compatibility tests.

Within Eglin airspace, the Navy's Aegis cruisers perform missile exercises, and Tomahawk missiles utilize both the land and water range areas. The Tomahawks are launched over water to a land impact area at Eglin.

Restricted Area 2508 (R-2508) Complex. R-2508 is located in east-central California and extends into a portion of Nevada (Figure 3.4). It is the largest single area of over-land special-use airspace within the United States. The complex airspace is over all three primary users: the AFFTC Edwards, the NAWCWD China Lake, and the National Training Center, Ft. Irwin, California. The complex consists of the overlying R-2508, five underlying restricted areas, and ten memorandums of agreement. Typical operations within R-2508 include

- aircraft research and development in all stages of flight
- operational weapon T&E flights
- student pilot training

Figure 3.4
Airspace in the Western Test Ranges



RAND *MG619-3.4*

- air combat maneuvering and proficiency flights
- civilian test aircraft in direct support of DoD and/or defense testing.[29]

Scheduling of airspace use is coordinated among each of the three primary users. AFFTC (Edwards AFB) utilizes R-2508 to support testing of manned and unmanned aircraft and related avionics, flight-control, and weapon systems. Edwards AFB also operates the Air Force TPS. To support testing, the AFFTC operates the Edwards Flight Test Range, which comprises 20,000 mi^2 of airspace. The main runway at Edwards AFB is 15,000 ft long, with a 9,000-ft lakebed overrun.

NAWCWD China Lake utilizes R-2508 in support of primary research and development, T&E work for air warfare, and missile weapon systems. The Navy and Marine Corps have developed or tested nearly every significant airborne weapon system in the past five decades at NAWCWD. Operations at NAWCWD involve programs that range from the Tomahawk Cruise Missile to the new JSOW and from the JDAM to the new F/A-18E/F Super Hornet.

Sea Range Complex (SRC). SRC is located along the California coast, just north of SCORE (Figure 3.4). The mission of SRC is to support the Navy's research, development, test evaluation, and in-service engineering center for weapon systems associated with air warfare, missiles and missile subsystems, aircraft weapon integration, and assigned airborne EW systems.

The SRC includes Naval Base Ventura County (formerly NAS Point Mugu), California, which also encompasses Point Mugu, the Laguna Peak complex, San Nicolas Island, and Santa Cruz Island. SRC contains 36,000 nmi^2 of controlled air space. In addition, SRC can connect to Naval Air Weapons Station China Lake via a Federal Aviation Administration (FAA)–approved flight path.

Naval Base Ventura County maintains three runways, including 11,000-ft and 5,500-ft runways at Point Mugu and a 10,000-ft runway on San Nicolas Island. The surface launching and ordnance facilities at Point Mugu support operations at SRC.

The Laguna Peak complex provides optical coverage, telemetry, airborne and surface target control, radio communication and data transmission, surveillance radar, and the Command Transmitter System.

San Nicolas Island has an area of approximately 24 mi^2; the west end provides a secure area for missile targets. Its capabilities include launching subscale and unmanned full-scale targets and launch sites for surface-launched weapons. The airfield on San Nicolas Island can support aircraft up to and including the C-5. In addition, the island has a beach landing area for bulk barge cargo transportation.

AFFTC routinely conducts operations within the Sea Range Complex, especially operations requiring flight at near sea level, large footprint weapons, and directed energy systems.

In summary, the ranges have the following areas, in square miles:

- Eglin land: 724
- Eglin sea: 98,000
- Edwards land: 470
- JSRAC R-2508: 26,000
- China Lake land: 1,718
- Point Mugu sea: 46,000.

[29] According to R-2508 staff, 2006.

Scheduling Exercise

From January 30 to February 3, 2007, schedulers from the 46th and 412th Test Wings sat down together to input 17 weeks of Eglin range activity into the Edwards range-scheduling system.[30]

This exercise focused on range capability, not range capacity. In particular, the methodology assumed unlimited staff availability to support the transfer of activities being studied. This would highlight potential deficiencies in capability. The analysis showed that Edwards AFB and its range could not support the entire Eglin workload over the 17-week period. However, the combined capabilities of the WTR—specifically, Edwards, the Point Mugu sea range, and China Lake—could support almost all the Eglin the workload, except possibly the telemetry. In the exercise, all the sorties were launched from Edwards. Sixty percent of the missions could be completed with Edwards capabilities alone. Twenty percent required support from the Point Mugu sea range, and another 19 percent required support from China Lake, Edwards, and the R-2508 complex. About 1 percent required support from other ranges, such as the White Sands Missile Range.

This exercise generated specific lists of tasks that Edwards, China Lake, and Point Mugu would need to perform. In no case does the WTR, as it now exists, have the capacity to support the additional operations required. However, the WTR does appear to have adequate capability to support the additional operations, except for a possible shortfall of telemetry bandwidth.

Telemetry

The scheduling exercise identified a potentially serious shortfall in the capability of WTR telemetry to support the combined Eglin and WTR workload. In particular, there appeared to be a shortage of bandwidth at S-band to support consolidated operations. On this issue, Eglin and Edwards did not reach consensus. Edwards schedulers believed that the inherent flexibility of the short-term scheduling methods would enable the WTR to provide adequate telemetry support to the Eglin mission load. Eglin schedulers did not concur.

For the purposes of this study, we did not attempt to resolve this disagreement independently. We proceeded on the conservative assumption that Eglin's view was correct and that the telemetry systems of the ranges would have to be improved to deal with this possible capability constraint.

We note that, in the Navy's response to the Eglin-Edwards scheduling exercise, China Lake reported that it would not be able to support Air Force operations at the proposed level unless the Air Force aircraft involved were upgraded to support Advanced Range Telemetry (ARTM) Tier I. The core of our analysis was determining the cost to the Air Force of upgrading all test aircraft to at least the ARTM Tier 1 standard.[31]

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[30] Appendix A reproduces a report on this exercise that we received from the Eglin Range Group. This report is included to provide background for and visibility into our analytic process. It is not a RAND document. Its conclusions are not the final conclusions of our analysis. Our complete analysis is partly based on important information not available to the authors of Appendix A at the time it was written.

[31] With increasing emphasis on jointness, the Air Force will likely have to do this anyway, as it has in other locations that use joint facilities or ranges.

Basic Technical Issue

The basic technique of pulse code modulation (PCM)—sending digital data on RF—was first developed in 1926. Over the decades it has been continuously improved to carry more data in a fixed bandwidth with the lowest possible error rate.

Modern quadrature phase shift keying (QPSK) encoding systems are roughly three times as efficient in use of bandwidth than older PCM and frequency modulation (FM) systems. This is not a function of the basic radio technology of transmitters, receivers, or antennas but of the algorithm used to generate an analog signal from digital data. Even a tiny improvement in the amount of digital data that can be transmitted in a fixed bandwidth is valuable to bandwidth-constrained industries, such as cellular telephone providers. Because of the magnitude of revenues involved, the commercial world has invested heavily in recent decades on schemes to use bandwidth more efficiently. Unlike these companies, the military has not explicitly had to buy bandwidth on the open market and has, perhaps for that reason, lagged behind commercial users in adopting the most efficient techniques.

Nevertheless, WTR has invested in equipment using modern encoding, in particular, Feuer QPSK (FQPSK), a shaped offset QPSK derivative. This system is compliant with the RCC Telemetry Standard IRIC 106 and is often referred to as *ARTM Tier 1*.[32]

However, despite the fact that the telemetry ground equipment is set up to handle FQPSK, this encoding technique cannot be used unless the aircraft transmitting the telemetry is also using it. Air Force range-owned aircraft are generally equipped to transmit using PCM/FM (ARTM Tier 0). The test wings have plans to upgrade their aircraft, but these plans have not yet been implemented.

Figure 3.5 illustrates the key technical issue, the bandwidth needed to support digital encoding methods. The relatively broad shoulders of the older PCM/FM encoding systems make it difficult for other users to operate in nearby frequencies. The more-modern FQPSK system has a narrower frequency footprint, allowing more-efficient use of available bandwidth.

Cost to Upgrade

New radios will replace existing PCM/FM systems. There is no reason to believe that the replacement systems will have space, power, or cooling requirements greater than those of the systems they replace. The required radios are readily available from commercial suppliers. For our cost estimates, we assumed that the cost per radio upgrade is $5,000 and that the cost to install, test, and document the new radio is another $5,000. In addition, we assumed that the overall upgrade program would have an administrative cost of $500,000.

Except for the cost of the radios, which are commercial products, these cost estimates are arbitrary. Nevertheless, it is striking that these costs are very low compared to other costs examined in this monograph. It may appear unusual that such inexpensive, well-understood upgrades have not already been implemented. A key point here is that the Air Force has been able to perform its mission with the older radios. That is, even though the cost of the upgrade is very low, there has been, until now, no particular reason to make the upgrade a priority for allocation of limited funds.

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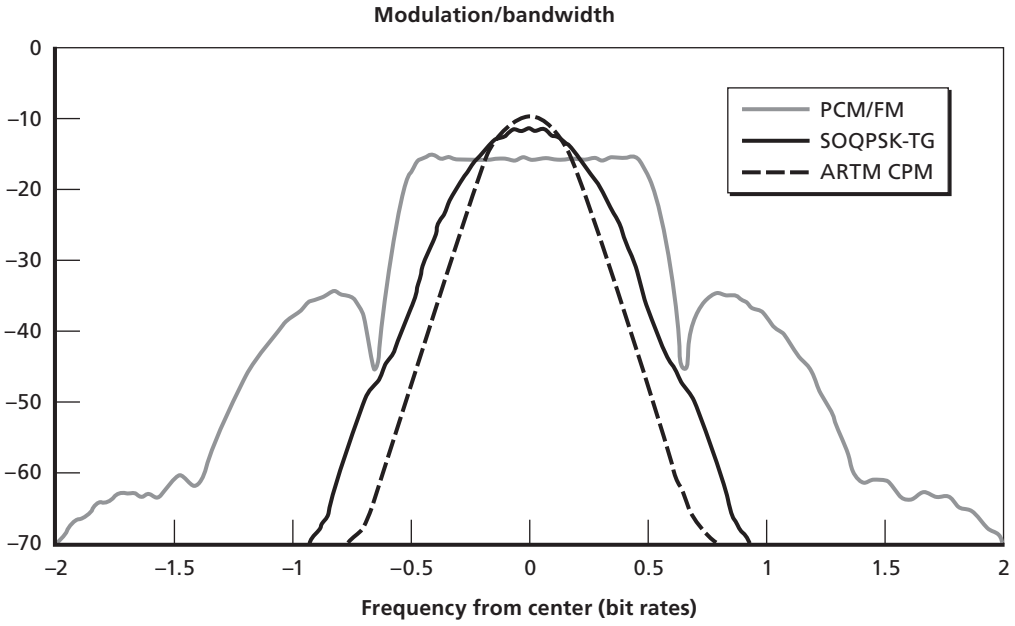
[32] ARTM is an OSD-funded program to upgrade telemetry systems. Tier 0 is PCM/FM; Tier 1 is shaped offset QPSK; and Tier 2 is continuous phase modulation (CPM). Tier 1 capability has already been installed on the network of telemetry ground stations at Edwards.

Figure 3.5
Modulation and Bandwidth



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Note that these costs are for upgrading aircraft radios to support consolidation of current wing capabilities. Of course, the ranges will continue to support older encoding techniques. There will likely be situations in which it is necessary or advantageous to upgrade the radios on individual weapons. We have not included that cost here.

While the formal analysis here has looked at current levels of activity, note that the Air Force will in future years migrate to more net-centric forms of warfare and that this migration will substantially increase Air Force requirements for radio communications throughput. Regardless of whether wing consolidation occurs, all Air Force ranges will have to invest in new communications capabilities. In particular, the Air Force will have to migrate to more modern methods of spectrum management, including Internet-protocol radios and spread-spectrum operations. Communications will require use of higher frequencies and more use of directional antennas.

Spectrum access will continue to be an issue. Future spectrum access will not be managed just within the T&E community but on the DoD-wide and nationals. Future tests will benefit from their distance from civilian populations and other DoD activities that raise the noise floor. However, we have not included this in the analysis reported here.

Western Test Range Effects

Edwards' analysis of the requirements generated by the scheduling exercise indicated that, based on experience, the Edwards range would have to go to a full two-shift operation. This would require an increase of 64 personnel. Edwards did not explicitly calculate hardware costs, but these are clearly small. We estimate that necessary upgrades to the telemetry capability of test wing aircraft would require a one-time charge of about $1 million.[33]

[33] Eglin has independently estimated a cost of $500,000. We do not dispute that number but have opted for a more-conservative assumption in this analysis.

China Lake and Point Mugu would be affected considerably less than Edwards would. China Lake has estimated that, to support its share of the Eglin workload, it would need an additional ten personnel. In addition, China Lake would sustain increased recurring costs of $70,000 per year and a one-time cost of $250,000. Point Mugu estimated that it would require an additional five personnel and a one-time cost of $100,000.

Cost Assumptions

Our analysis focused on the relative costs of conducting operations at various facilities. We were not concerned with the details of how work is apportioned between, for example, civilian government employees and contractor employees or the details of each contract. We have therefore made the simplifying assumption that contractor costs per employee will be the same at all facilities except for variations caused by differences in overall wage levels in different geographic areas. For the wage-level difference, we used the differentials OPM has calculated to determine locality pay adjustments for federal employees. According to OPM, both Edwards AFB and NAWC Point Mugu are in the Los Angeles area. Both NAWC China Lake and Eglin AFB are in the "rest of the United States" category. According to OPM, federal workers should be paid 10.1 percent more if they work at Edwards or Point Mugu than if they work at China Lake or Eglin. To comply with that direction, we assumed that contractor employees will cost $100,000 per year at Point Mugu and Edwards and $90,800 per year at China Lake and Eglin. These sums do not reflect the actual labor costs of contracts at either facility but are rough estimates of the total cost to the federal government of employing people.

We assumed that Eglin would pay transition costs equal to 20 percent of other annual costs for each employee no longer required and that the facilities gaining employees would pay 50 percent of their annual cost as a transition expense. For the actual reduction in employment, we have assumed, using information from Eglin, that the range contract would be reduced by the equivalent of 698 positions. Of these, 647 are people attached to open-air testing, and 51 are in range administration.

We note that the additional employees at Edwards, Point Mugu, and China Lake would be a small group compared to the existing large workforces with the relevant skill set. Both Edwards and Point Mugu are located in areas with large labor pools. This has not always been true of Edwards in the past, but the population of the Antelope Valley, in which Edwards is located, has recently undergone rapid growth as a bedroom community, housing workers who commute to Los Angeles. These workers would find it much easier to commute to Edwards than to Los Angeles. China Lake is different; it does dominate the labor market in the nearby town of Ridgecrest. However, we expect China Lake to add only ten employees, a small number compared to the 7,000 currently employed there. So, we have not assumed that heroic efforts will be needed to attract workers to any of these facilities.

Throughout, we have assumed that transition costs are incurred in FY 2009 and that recurring costs and savings begin at that time. All costs are in thousands of 2007 dollars. Table 3.4 summarizes our cost estimates for range consolidation. Total FY 2007–2011 FYDP savings equal $149 million.[34]

[34] See Table C.12.

Table 3.4
Cost Estimate Summary for Range Consolidation

	Eglin	Edwards	China Lake	Point Mugu	Total
Number of employees	(698)	64	10	5	(619)
Cost per person ($000)	91	100	91	100	
Personnel transition costs ($000)	12,676	3,200	454	250	
Other transition costs ($000)		1,000	250	100	
Recurring costs ($000)			70		
Total transition costs ($000)	12,676	4,200	704	350	17,930
Total recurring costs ($000)	(63,378)	6,400	978	500	(55,500)

NOTE: All costs are in 2007 dollars.
Summary over FYs 2007–2011: ($148,572).

Observations

Economy of Scale in Range Operations. The potential cost savings from range consolidation are quite large. They also manifest themselves very quickly, showing a positive return even over the FYDP. These are attributable to the facts that range operation is very labor intensive and that range operations exhibit large economies of scale.

We were surprised by the extent of the economies of scale. However, after detailed investigation, we are convinced that they are real and are inherent in range activities. Range work includes many different activities that take place at many different physical locations. Often, the success of a test depends on coordinating many of these activities. Yet testing is often, by nature, unpredictable. The upshot of this is that workers on the range often spend time waiting for something to happen. This may seem wasteful, but it is obviously better to have a worker in a pickup truck waiting for a B-2 to show up than the other way around.

So, in general, because there is more activity on the range, there is more opportunity for efficient scheduling, creating economies of scale. One Eglin leader commented that it takes about 500 people just to have a basic range capability. That fits with our observations. However, once one pays for that basic capability, the range can support quite a lot of activity at only modest additional cost.

From the Air Force's point of view, the question is why, given this high fixed cost of keeping a range in existence, it should have more ranges than necessary. The analyses that the ranges and RAND conducted in connection with this project indicate that the WTR is capable of supporting the entire Air Force requirement for open-air, fixed-wing, developmental testing. It is therefore not surprising that large cost savings can be achieved by consolidating operations at one range.

In principle, one might ask about the consequences of moving activity from the WTR to Eglin. We were not asked to study this issue.

Dependence on Other Activities. Consolidation of range activities cannot be achieved in isolation. Obviously it requires moving most of the 46th Test Wing's flying-hour operation to Edwards AFB. The costs and benefits of range consolidation and wing consolidation can only be considered together.

However, consolidation of open-air testing does not require moving other testing activities from Eglin AFB to the WTR. For example, the BISS is administratively connected with the Eglin open-air testing range, but there is no operational reason that it needs to be physically close to open-air testing. The analysis in this section should not be considered to comment on activities other than open-air testing.

Cooperation with the Navy. The consolidation of Eglin open-air testing and the WTR can only succeed with the cooperation of the Navy. Edwards cooperates with the Navy in many ways every day. R-2508 airspace is managed jointly. Military radio frequencies are managed jointly through the Integrated Frequency Deconfliction System. Edwards aircraft frequently deliver munitions to test sites at China Lake. However, the extent of joint cooperation would increase substantially if Air Force open-air developmental testing were consolidated in the WTR. This report has focused on the physical capabilities of the WTR and the cost implications of operations there. But there are management and policy issues in joint cooperation that deserve serious consideration and joint discussion before the Air Force commits to a path that makes it more dependent on the Navy.

User Versus Institutional Funding of Test Activity. This chapter examined the total reduction of costs to the U.S. government. We have estimated a total recurrent savings of $55 million per year to the Air Force from OAR consolidation. How much of that savings will be credited to institutional funding will depend on how activities are billed at the WTR. Assuming that WTR operations are 50-percent RBA and 50-percent DBA, the T&E enterprise would realize estimated savings of $28.5 million per year, and the customer programs would save the other $28.5 million.

Cost Sensitivity to Assumptions. Two areas of uncertainty are whether the Navy can really support additional activity at the WTR with the staffing it estimates and whether the Air Force would really decide to reduce the Eglin range by 689 positions. In Table C.11, we present a case in which the Navy's staffing requirement is three times higher than in the base case and the Eglin range retains 748 staff, rather than the 509 staff retained in our base case. In that scenario, FYDP savings decrease to $78 million.

Summary

Consolidation of open-air developmental testing provides an opportunity for the Air Force to save substantial resources. These savings come from consolidation of test wing staff and increased OAR efficiency. Wing consolidation can succeed only if the Navy supports expanded Air Force activity at western Navy ranges.

CHAPTER FOUR

Facilities

Overview

As part of the PBD-720 funding cuts, AFMC identified five T&E facilities for closure or divestiture, one for mothballing, and one for reductions. The facilities are listed in Table 4.1.

To assess the effects of these proposed closures, RAND visited each facility, interviewed personnel and collected information from Air Force Headquarters, AFMC, TRMC, the test centers, and others knowledgeable about the T&E process and these activities. In addition,

Table 4.1
Facilities Proposed for Closure

Facility	Description	AFMC-Proposed Action
Central Inertial Guidance and Test Facility (CIGTF)	Inertial and GPS testing GPS jamming GPS system enhancements	Close or divest
Guided Weapons Evaluation Facility (GWEF)	Tests munitions seekers and sensors Countermeasures EO, IR, RF, millimeter wave (MMW), and laser target signatures	Close or divest
Joint Preflight Integration of Munitions Systems (J-PRIMES) Facility	Simulates in-flight electromagnetic conditions Joint Air Force–Army management	Close or divest
McKinley Climatic Laboratory (MCL)	World's largest environmental test chamber Temperature, wind, precipitation, salt, dust, icing, and solar radiation	Mothball
Seeker-Signature T&E Facility (STEF)	Measures target signatures 300-ft tower and turntable	Close or divest
Benefield Anechoic Facility (BAF)	World's largest anechoic chamber Large aircraft or up to four fighters Benefield Anechoic Facility and J-PRIMES only Air Force chambers for full-size aircraft	Reduce
National Full-Scale Aerodynamic Complex (NFAC)	World's largest wind tunnel Leased from the National Aeronautics and Space Administration (NASA) Two tunnels sharing drive Only suitable facility for full-scale rotorcraft Also useful for fixed-wing aircraft at high angles-of-attack	Close or divest

questionnaires were sent to selected alternative facilities to attempt to assess their ability to absorb the work displaced from the Air Force facilities.

This chapter provides a general description of each facility, with relevant background information on the facility and its history. We then list current and near-term customers, recognizing that as much as 50 percent of the business of many T&E facilities may consist of "walk-ins," testing that was not scheduled in the initial planning process. (This is particularly true of the facilities that primarily do short-duration tests, e.g., installed system test facilities.)

We then attempt to identify and discuss the most likely alternatives available to customers, assuming that their test requirements remain constant. To collect this information, we used a combination of written sources (primarily data previously collected by TRMC) and questionnaires sent out along with the 46th Test Wing's summary descriptions of the ongoing and planned work in each facility and responses from the Navy activities involved in the transition planning exercise. It is important to recognize that these assessments should be considered to be notional because of the summary level of information exchanged and the limited time available for coordination and clarification. Still, they do give the participants' view of the available capacity. In general, none of these facilities exactly duplicates the capability of any other, so assuming equivalencies considerably oversimplifies the situation. The true comparability can be determined only by customers and subject-matter experts judging against a specific set of requirements.

The cost data used in this analysis had to be collected directly from the test organizations to get sufficient visibility into the funding of specific activities. When projections had to be made, they were generally based on FY 2006 actual costs, since this was the first year of operation under the NDAA 03 charging policies.[1] Cost estimates of the effects of facility closure or reduction on the unclassified various customers were taken from an AAC customer impact study (AAC, 2006). In most cases, documentation on how these estimates were developed was not available, and limited time and resources did not permit independent verification of estimates from the customers. All costs are presented in constant FY 2007 dollars.

Cost summaries are presented by the average annual recurring infrastructure cost (DBA) from FY 2006 through 2011. This is, effectively, the fixed cost to the Air Force of retaining these facilities. It excludes improvement-and-modernization costs and customer costs but includes military personnel costs.

The full operating costs of the facilities from FYs 2007 through 2011 are presented for both continued operation (status quo) and after the AFMC proposal reductions.[2] These costs include recurring infrastructure, nonrecurring improvement and modernization, closure costs, costs to other services to assume divested workload, and customer test costs (RBA) that include test costs paid by the users and the AAC estimates of additional costs T&E customers would incur as a result of the AFMC proposal. (Customer usage costs are assumed constant across

[1] The National Defense Authorization Act of 2003 (NDAA 03) changed the way test activities charge for their services. To encourage more-thorough testing, the act directed that DoD test customers would only pay the test activities for the direct (or incremental) costs incurred by testing that program. All infrastructure and overhead costs were to be funded by the military departments or defense agencies. This meant that, while programs had to pay for program-specific test activities, they could not be charged any of the fixed cost of operating, maintaining, or upgrading the test activity. These changes took effect in FY 2006. In Air Force terminology, institutional funding is referred to as DBA, and customer charges are referred to as *RBA*.

[2] For the facilities portion of the analysis, AFMC's reductions were taken as proposed with the exception of delaying action on J-PRIMES until FY 2009 to better coordinate with the timing of the proposed test wing and flight-test consolidation.

both alternatives per our ground rule that customer test content must be held constant under all alternatives.) Appendix D provides additional detail on the costs for each facility.[3]

Central Inertial and Guidance Test Facility

Description

The CIGTF is located at Holloman AFB, New Mexico, adjacent to the White Sands Missile Range and is operated by the 746th Test Squadron.[4] It provides testing services for GPS and inertial navigation systems in laboratory, ground, flight, and high-speed sled environments. It can provide highly precise time, speed, and position information in clear or jamming environments. It has extensive GPS jamming capabilities and has the open-air range and clearances to conduct these tests. For testing inertial systems, it has rate tables, an environmental test chamber, and a 50-g three-dimensional centrifuge housed in a seismically quiet facility. These high-precision capabilities are needed for testing intercontinental ballistic missile guidance systems (CIGTF's original mission) and directed-energy pointing systems.

The 746th Test Squadron consists of 88 civilians (25 of whom are dedicated to supporting the high-speed test track, flight-test instrumentation, and information technology support), 22 military personnel, and 7 contractors. Its location in southern New Mexico provides access to the White Sands Missile Range for open-air jamming tests, use of the 10-mi-long Holloman High-Speed Test Track to verify and calibrate references, and a seismically stable area for precise inertial testing. CIGTF is currently operating at approximately 85 percent of capacity (personnel limited).

Customers

CIGTF has state-of-the-art capability for testing the following:

- inertial navigation systems
- GPS user equipment
- integrated or embedded GPS and inertial systems (EGI)
- GPS performance in jamming environments
- GPS precision landing systems
- GPS system enhancements.

Figure 4.1 shows the distribution of test workload for FYs 2004 through 2006. Table 4.2 lists CIGTF's customers for FY 2007.

Alternatives

No alternative facilities perform the range and quality of navigation testing available at CIGTF. The 1995 BRAC commission directed the consolidation of DoD inertial guidance testing at CIGTF. The extreme precision required for inertial systems in ICBM and directed energy pointing applications requires the significant infrastructure and expertise available at CIGTF,

[3] The effects of rounding should be taken into account in assessing cost data presented in the tables..

[4] The information in this section is taken from communications with 746th Test Squadron; AAC, 2006; TRMC, 2006g; and AFMC, 2007b.

Figure 4.1
CIGTF Labor by Test Type

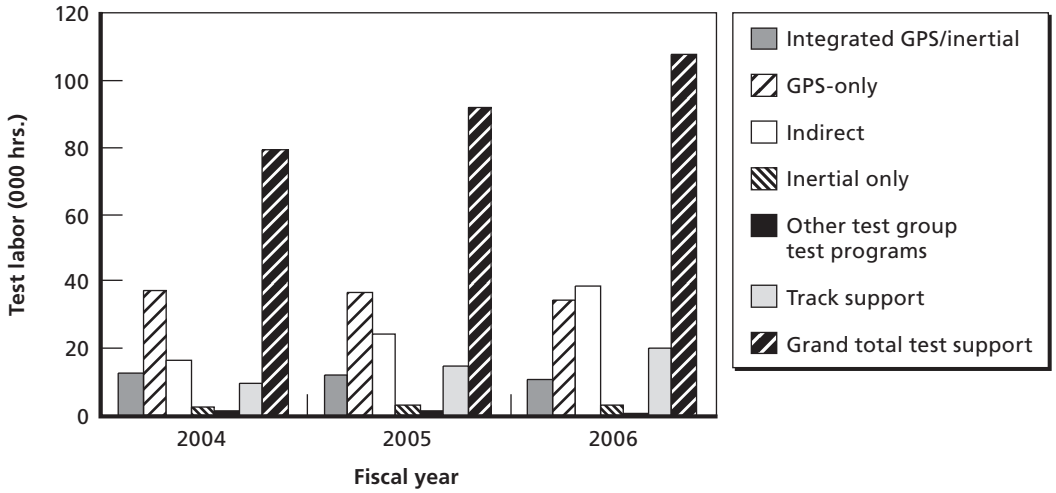

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Table 4.2
CIGTF FY 2007 Customers

Period	Program	Type of Test
October 2006	JPALS	GPS/inertial
	T-38 FLDR	Inertial
	TBC	Inertial
	TELCOM SIM	GPS
November 2006	JPALS	GPS/inertial
	HST	Inertial
	TBC	Inertial
December 2006	ALCM	GPS/inertial
	BTERM	GPS/inertial
	HST	Inertial
	GCCU	GPS/inertial
	Micro GPS Jam	GPS
January 2007	OP32	GPS
	SPACE TELESCOPE	Inertial
	MICRO GPS JAM	GPS
	F16-EGI	GPS/inertial
	MICRO GPS JAM	GPS
	SPACE TELESCOPE	Inertial
	OP32	GPS
	B-52 AMI	GPS/inertial
March–September 2007	MH-53	GPS/inertial
	T-38 FLDR	Inertial
	CV-22	GPS/inertial

Table 4.2—Continued

Period	Program	Type of Test
March–September 2007 (cont.)	Micro GPS Jam	GPS
	Anomaly Resolution	SMC
	TBC	Inertial
	WSEP	GPS
	F-16 EGI	GPS/inertial
	BTERM GUFT	GPS/Inertial
	SDB	GPS
	EKV IMU	Inertial
	AEP	GPS
	Talon Gnarly Head	GPS
	Talon Namath	GPS
	Ginger Doe	GPS/inertial
	RADIX	GPS/inertial
	C-130 AMP	GPS/inertial
	JIPSM	GPS
	MAGR ECP-50	GPS
	GYPSY GOLF	GPS
	TELSIM	GPS

particularly the centrifuge and precisely instrumented sled track. CIGTF has also become the primary DoD facility for GPS testing, particularly for high-velocity systems in a jamming environment. The combination of GPS and inertial guidance into an embedded EGI system (installed in F-15, F-16, F-22, F-35) requires robust test capabilities in both areas.

The Naval Air Warfare Center at China Lake, California, has some capability for testing tactical weapon navigation systems but lacks the precision needed for some applications. According to TRMC, China Lake's capacity for GPS jamming tests is restricted because of interference with other range users and the difficulty of getting necessary clearances for GPS jamming. The sled track at China Lake is less than half as long as the one at Holloman and lacks comparable precision measurement capabilities. TRMC also determined that China Lake has limited capacity for additional work because of staffing limitations.

The Army Electronic Proving Ground at Ft. Huachuca, Arizona, can do limited GPS testing for low-dynamic systems (no aircraft or missiles) in a jamming environment. It has no inertial capability.

Neither China Lake nor Ft. Huachuca can provide precise time, speed, and position information in a jamming environment.

Costs

RAND collected cost and staffing data from the 746th Test Squadron. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and the AFMC proposal. For the purposes of this analysis, the staffing cuts associated with the AFMC proposal were phased in over FY 2008. A 25-person staff was assumed to remain to provide the required support to the sled track, flight instrumentation, and help desk. The

customer cost effect of $13.7 million per year for all customers was taken from the AAC study. This figure could not be independently verified.

As is shown in Table 4.3, the annual cost of operating the CIGTF, exclusive of improvement and modernization projects, is approximately $7.7 million. AFMC's proposed plan results in a negative net savings, due to the substantial effects on customer costs.

Conclusions

The CIGTF performs an important role in an era of increased emphasis on long-range, precision-guided munitions that must frequently operate under the constraint of minimizing collateral damage. Achieving these objectives requires precise navigation for both the weapon and the platform. In addition, the proliferation of GPS-aided guidance systems raises the need for robust testing against potential countermeasures, such as jamming. The variability of jamming effects that are due to aspect, shadowing, signal strength, and reflections makes the ability to test the complete system under realistic operational conditions essential.

Another important consideration is the specialized knowledge of the 746th Test Squadron staff. The GPS Joint Program Office depends on their expertise to test the GPS space segment signals and to control segment software upgrades.

Considering the uniqueness and importance of the CIGTF testing capabilities, the large number of programs that use its services, and the relatively small infrastructure savings divestment could achieve, it appears that it would not be cost-effective to close this facility.

Guided Weapons Evaluation Facility

Description

The GWEF is an HITL facility with 13 test areas for testing air-to-air, air-to-surface, and surface-to-air seekers and sensors.[5] It creates a virtual environment to allow simulation and stimulation of actual hardware operating in the EO, IR, laser, RF, and MMW spectra. The GWEF can provide the following types of test support:

- munitions performance assessment (miss distance, probability of kill, etc.)
- countermeasure effectiveness assessment
- preflight predictions and post-flight analysis
- seeker and sensor parametric characterizations

Table 4.3
CIGTF Cost Results (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	7,680		7,680
Status quo operation, FYs 2007–2011	50,193	39,681	89,874
AFMC proposal, FYs 2007–2011	19,795	94,648	114,443
Savings, FYs 2007–2011	30,398	(54,967)	(24,569)

[5] The information in this section is taken from communications with 46th Test Wing; communications with 412th Test Wing; AAC, 2006; TRMC, 2006c; AFMC, 2007b; NAWCWD briefing; Dyess, 2007f; and Dyess, 2007c.

- high-power microwave effects
- validated target and background models (both ground and aerial)
- EO, IR, RF, MMW, and laser target signatures.

The GWEF is housed in a secure 94,000 ft^2 facility at Eglin AFB and is operated by the 46th Test Wing. The facility has nine flight motion simulators and four high-fidelity IR scene projectors and is the sole provider of robust imaging IR countermeasure simulators. It can provide validated target, background, and countermeasure simulations depending on customer requirements.

The approximately 50-person staff of government employees and contractors has extensive expertise in U.S. and foreign weapon guidance and control. The staff develops validated CHAMP IR target signature models for DoD, the intelligence community, and others and maintains all signature data for Eglin activities.

Customers

Because of the nature of the testing done in the GWEF and the effort required to tailor and set up the test environment, customers typically plan to use the facility for extended periods, often years. Table 4.4 shows GWEF customers for FY 2007 and out, planned durations, manpower, project days, and estimated effect on customers of closing the GWEF.

Alternatives

One of the challenges in a study of this type is to compare alternatives with similar but not identical capabilities. A number of other facilities have capabilities similar to the GWEF's. Within the Air Force, the AFEWES at Ft. Worth, Texas, could assume at least some part of the GWEF workload. AFEWES is a smaller government owned, contractor operated facility, emphasizing shorter-duration IR testing for many customers against various threats. RF threats can be simulated via signal injection.

In its response to a data call requesting information on its ability to assume the workload of the GWEF, the 412th EWG's assessment was that, while the AFEWES has the capability to assume most GWEF test activities, it would have capacity constraints. This would result in a shortfall for IR customers of 400 to 600 days per year for the work defined. The additional GWEF workload for classified programs was not provided and thus could not be assessed.

Another potential alternative facility is the Navy's Integrated Battlespace Arena (IBAR) at NAWCWD China Lake, California. The IBAR is a 50,000 ft^2 integrated weapon-development laboratory consisting of ten interconnected facilities. The IBAR has a broader focus than does the GWEF, including mission planning, networking and information exchange, virtual prototyping, operation of unmanned aerial vehicles, and GPS/inertial systems. Its anechoic facilities are smaller but generally comparable to those of the GWEF, except for lacking the MMW capability. The IBAR does not have the GWEF's resistor array technology for target simulation.

The Navy provided rough estimates of what would be required to absorb approximately 70 percent of the GWEF workload at IBAR.[6] The assumption was that two 5-axis tables would be transferred from the GWEF and reinstalled at China Lake. This would require a new pump

[6] These estimates did not include the classified programs, SDB ll, or approximately half the activities of the Eglin Signatures Data Center.

Table 4.4
Affected Customers

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effect of Closing GWEF
HITL Dynamic Msl Sim	07/06–11/06	DoD	1,500	90	Classified
Direct Infrared Countermeasures Technology Assessment Program—CH-53	12/05–11/06	DoD	12,000	240	Cannot complete 20 percent of test matrix, data reduction, or reporting. IR countermeasure systems will not be fully tested, putting CH-53 crews at risk.
DOME Phase II	09/06–02/07	DoD	1,500	80	Classified
Department of Homeland Security (DHS)–BAE Commercial	8/06–03/07	Comm	2,800	140	BAE Systems will not complete testing, which will affect ability to produce commercial aircraft protection system.
Large Aircraft Survivability Initiative (LASI) Boeing 747	01/03–06/07	DoD	24,000	1,200	LASI will not complete testing, which will affect assessment of commercial and DoD aircraft survivability. Will directly affect airborne laser live-fire T&E schedule.
LASI/TSA Boeing 737	01/06–12/07	Gov	6,000	300	LASI will not complete the IR model, which will affect the Transportation Security Administration's ability to assess commercial/DoD aircraft survivability.
Improvement and Modernization (I&M) Scene Characterization and Reconstruction for Advanced Munitions	10/01–5/07	AFMC DBA	11,900	1,248	Cannot complete final integration of capabilities, affecting most GWEF customers adversely.
I&M Air Moving Target Indicator	10/08–09/14	AFMC DBA	27,000	624	Cannot execute program. Existing equipment will be obsolete and unsupportable, affecting all GWEF customers. Emerging R&D programs involving GPS, IIR, laser detection and ranging, and low-observable technologies will be unsupported, increasing program risk.
Advanced Threat IR Countermeasure	08/05–09/08	DoD	1,500	300	Cannot complete testing and will significantly affect ability to assess effectiveness of its IR countermeasures systems.
LASI/NASA Boeing 757	02/07–09/07	DoD	12,000	250	LASI will not complete testing, which will significantly affect NASA's ability to assess commercial/DoD aircraft survivability.
DHS-Counter MANPADS	11/06–09/07	DoD	7,200	175	DHS will not complete testing, which will affect its schedule to produce commercial aircraft protection system and increase risk.
Small Diameter Bomb Increment II	07/06–TBD	DoD	TBD	TBD	Schedule under negotiation. Prime contractor for this program will be severely limited in HITL testing options and will see increased schedule risk.

Table 4.4—Continued

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effect of Closing GWEF
Eglin Signatures Data Center	10/03–09/08	DoD	12,500+	1,300+	EO/IR/frequency response/MMW/acoustic community will be without support to obtain signature data, increasing cost and risk to programs.
GTS	10/03–09/12	DoD	150,800+	2,470+	Classified
Large Aircraft IR Countermeasures	10/02–09/12	DoD	115,440+	1,950+	This will not complete significant amount of budgeted testing. Less testing means higher program risk in fielding the current program and highly increased technical risk.
Miniature Air-Launched Decoy (MALD)	10/03–09/08	DoD	41,240	1,180	MALD's prime contractor, Raytheon, will lose its only HITL test capability, greatly increasing technical risk to program.

SOURCE: Dyess (2007f).

house and modifications to the existing labs. The modifications are estimated to cost approximately $4 million to 6 million. No estimate was provided for the cost of moving the rate tables from Eglin and installing them at China Lake. The Navy estimated one-time costs of $2 million to validate the new environment on completion and $0.4 million to manage the details of the transfer and that ten additional personnel would be required ($2 million per year). It also estimated that these actions would support the transition of one program requiring the use of a rate table and all those not requiring rate tables within six months, with the remaining customers complete in 12 to 18 months.

A third facility that has capabilities similar to the GWEF's is the Redstone Technical Test Center (RTTC) in Huntsville, Alabama. The RTTC has four HWIL facilities and is developing two more. The current facilities can support 11,776 facility hours per year. Although the Army response indicated that RTTC had the relevant capability, it made no specific assessment of capacity, citing the tailoring required for HWIL testing. Without a detailed understanding of the customer requirements and schedule, the Army was unable to estimate the costs of adapting its hardware and software to the needs of GWEF customers.

Costs

RAND collected cost and staffing data from the 46th Test Wing. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and for the AFMC proposal. For the purposes of this analysis, the staffing cuts associated with the AFMC proposal were phased in during FY 2007. Approximately $4 million was included for deactivation. To reestablish the GWEF workload at the IBAR, the Navy estimate of $6 million in FY 2007 and $1.7 million thereafter was included as an additional institutional cost to the Air Force. The customer cost effects used to calculate the AFMC proposal costs were taken from the AAC study. This number could not be independently verified.

As is shown in Table 4.5, the annual cost of operating the GWEF, exclusive of improvement and modernization projects, is approximately $6.3 million. The AFMC proposal plan results in a negative net savings because of the substantial effects on projected customer costs.

Table 4.5
GWEF Cost Results (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	6,316	N/A	6,316
Status quo operation, FYs 2007–2011	32,058	13,181	45,239
AFMC proposal, FYs 2007–2011	22,724	101,781	124,505
Savings, FYs 2007–2011	9,335	(88,600)	(79,265)

Conclusions

Given the information available to us, it is not clear that sufficient excess capacity exists to support GWEF customers in the near term. IBAR could, with some investment, assume a significant portion of the GWEF workload. AFEWES has limited additional capacity. The Army was unable to provide an estimate of the RTTC's ability to take on the GWEF workload without detailed requirements for each customer.

The advantages of proximity to the munitions program offices, the Air Force Research Laboratory munitions group, the operational test community, and the various range facilities are real but hard to quantify. The effect on customers is likewise difficult to estimate. Although the user analysis AAC conducted projects cost effects in excess of the institutional funding needed to operate the GWEF, these estimates could not be independently assessed because of the limited documentation and time constraints.

There are other facilities with similar, albeit not identical, capabilities. Since partial capabilities can often be adapted to meet customer demand, the issue comes down to capacity. The GWEF is currently staffed to operate about half of its facilities. Transferring its workload into alternative facilities would undoubtedly save some portion of its fixed costs (approximately $6 million per year). However, assessing this option requires a more-detailed study of the costs and potential effects on specific customers because this would be a complex process with significant potential disruption to ongoing programs. The advantages of continuing to operate the GWEF are that variable customer demand can be met with minimal disruption and that the intellectual capital and infrastructure can be preserved, enabling timely response to emerging threats and a higher confidence in the mission performance of weapons and countermeasures.

Joint Preflight Integration of Munitions and Electronic Systems Facility

Description

The J-PRIMES facility, located at Eglin AFB, consists of six laboratories that can be linked or operated independently.[7] This facility is part of the overall installed systems testing capability found at Eglin and simulates in-flight scenarios for both fixed- and rotary-wing aircraft. Simulations run at J-PRIMES make it possible to evaluate the performance of various weapon systems within a specified electromagnetic environment. A range of analyses can be conducted,

[7] The information in this section is taken from communications with 46th Test Wing; communications with 412th Test Wing, AAC, 2006; TRMC, 2006c; AFMC, 2007b; Dyess, 2007f; and Dyess, 2007c.

including IR, laser, inertial, and GPS guidance, to assess the operation of the systems and effectiveness of various countermeasures. To conduct these tests, J-PRIMES uses an anechoic chamber large enough to hold and test full-size Air Force and Navy tactical aircraft, as well as Army helicopters. The anechoic chamber is equipped with a 40-ton hoist.

The J-PRIMES facility operates under a joint business model that includes the 46th Test Wing and the Army's RTTC. The 46th Test Wing staff of J-PRIMES consists of six civilians and five contractors. According to TRMC, the workload at J-PRIMES is currently 60-percent Air Force and 40-percent Army testing.

Customers

J-PRIMES is capable of testing

- multispectral moving targets
- GPS satellite constellation
- C4ISR communication links
- dynamic flight motion for aircraft stores
- electromagnetic interference
- electromagnetic compatibility
- communications and navigation noise floors
- antenna pattern measurements.

J-PRIMES customers, schedules, and potential effects of closure for FY 2007 are shown in Table 4.6. It should be noted that, for installed-systems test facilities, such as J-PRIMES, user requirements and schedules tend to vary considerably, so forecasts over 12 months in advance tend to be uncertain.

Alternatives

The primary focus of the testing performed at J-PRIMES is the anechoic chamber, in which all the electromagnetic environmental effects testing is performed. Inside the chamber is advanced instrumentation for simulating the various threats. Anechoic chambers exist at several other locations. Possible alternatives to Eglin's J-PRIMES include NAWCWD's ACETEF and the Benefield Anechoic Facility at Edwards AFB. ACETEF is located at the Navy's testing facilities at Patuxent River, Maryland. Both locations have similar chambers and the potential to house the required test equipment.

Capacity at the other facilities could be a constraint. The current facilities at ACETEF would not be able to absorb 100 percent of the testing being conducted at J-PRIMES. A Navy review of the workload indicates that a new anechoic chamber, and the manpower associated with running it, may be required to conduct all J-PRIMES, as well as existing ACETEF testing workload. In addition, these two locations do not house exactly the same instrumentation, and thus some expense would be incurred to bring them up to the level of maturity of J-PRIMES. Another real, but hard-to-quantify, issue at J-PRIMES is the staff, which has a breadth and depth of experience that would probably take considerable time and effort to reconstitute. Also, both alternatives lack the small, specialized laboratories that J-PRIMES uses to conduct unique weapon-specification testing. Yet another significant consideration is collocation of such facilities with the test ranges. The test facilities are often used for pre- and post-flight test-

Table 4.6
Affected J-PRIMES Customers, Schedules, and Closure Effects

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effects of Closing J-PRIMES
MALD	09/06–10/06	DoD	1,920	30	Schedule delay Cost increase Technical development of threat scenarios Customer will likely test at Benefield Anechoic Facility
UC-35D	10/06–10/06	DoD	320	10	Schedule delay Cost increase Customer would test in open air
DJC2	08/06–09/06	DoD	900	15	Schedule delay Cost increase Open-air testing
URE	10/06–10/06	DoD	576	12	Schedule delay Cost increase Instrumentation technical development Customer would test in open air
CH-47F	11/06–11/06	DoD	320	10	Schedule delay Cost increase Customer would test in open air or at RTTC
A-10 SADL	11/06–12/06	DoD	768	12	Schedule delay Cost increase Customer would test in Benefield Anechoic Facility or Patuxent River
Theater High-Altitude Area Defense (THAAD)	12/06–12/06	DoD	720	18	Schedule delay Cost increase Customer would test in open air or at RTTC
UH-60M	12/06–12/06	DoD	320	10	Schedule delay Cost increase Customer would test at RTTC or Patuxent River
HH-60M	01/07–01/07	DoD	320	10	Schedule delay Cost increase Customer would test at RTTC
MH-53	01/07–02/07	DoD	1,920	30	Schedule delay Cost increase Negative effect on threat scenario technical development
Active Radar Homing	02/07–02/07	DoD	600	15	Schedule delay Cost increase Customer would test at RTTC or Patuxent River
URE	03/07–03/07	DoD	960	15	Schedule delay Cost increase Negative effect on instrumentation technical development Customer would test in open air
U2 ALQ 221	Multiple	DoD	1,440	30	Schedule delay Cost increase Negative effect on threat scenario technical development Customer would seek alternate location

Table 4.6—Continued

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effects of Closing J-PRIMES
TASKER	Multiple	DoD	480	20	Schedule delay Cost increase
SFW	Multiple	DoD	120	5	Schedule delay Cost increase

SOURCE: Dyess (2007f).

ing and analysis for tests conducted on adjacent ranges. Separating the installed-system testing from the test range will result in a much less efficient use of time and resources.

The 412th Test Wing EWG has evaluated the J-PRIMES workload and concluded that the Benefield Anechoic Facility, at its current capacity, could assume the J-PRIMES Air Force workload and a small portion of its Army work. In addition, if the flight-testing mission were to be consolidated on the western test ranges, the Benefield Anechoic Facility would become the preferred facility to perform pre- and post-flight testing for flights there.

The availability of the Benefield Anechoic Facility as an alternative, however, depends on the resolution of PBD-720 reductions to that facility. If subject to the 40-percent capacity reduction proposed by AFMC, the Benefield Anechoic Facility would be able to assume less than half the Air Force portion of the J-PRIMES workload.

Costs

RAND collected J-PRIMES cost and staffing data from the 46th Test Wing. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and the AFMC proposal. For the purposes of this analysis the staffing cuts associated with the AFMC proposal were phased in FY 2009 to coincide with the proposed shift of flight testing to the western ranges. Approximately $7 million was estimated by the 46th Test Wing for deactivation. The customer cost effect of $2.7 million in the first year and $0.2 million in subsequent years used to calculate the AFMC proposal costs was taken from the SAF/AQ study. This figure could not be independently verified.

As Table 4.7 shows, the annual cost of operating the J-PRIMES, exclusive of improvement and modernization projects, is approximately $1.4 million. The AFMC proposal plan results in a negative net savings because of the effects on customer costs.

Table 4.7
J-PRIMES Cost Results (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	1,407	N/A	1,407
Status quo operation, FYs 2007–2011	7,254	4,586	11,840
AFMC proposal, FYs 2007–2011	9,667	7,686	17,353
Savings, FYs 2007–2011	(2,412)	(3,100)	(5,512)

Conclusions

The testing conducted at J-PRIMES is fundamental to evaluating the performance of both fixed- and rotary-wing aircraft electronic systems within a range of electromagnetic environments. The instrumentation located at J-PRIMES can generate a range of conditions that cannot be generated elsewhere and much more effectively than what can be done in flight test. J-PRIMES is particularly valuable for pre- and post-flight evaluations in conjunction with range testing. Its relatively low cost and proximity to the Eglin range would argue against its closure. The Army, which depends heavily on J-PRIMES, has unofficially expressed interest in operating it should the Air Force decide to divest it.

McKinley Climatic Lab

Description

The MCL, with a main test chamber measuring 200 by 250 by 70 ft, is the world's largest environmental test chamber and is DoD's primary climatic test facility.[8] Unlike smaller climatic test chambers, it can accommodate full-scale test articles up to and including C-5–size aircraft. It can provide test environments with temperatures from –65 to +165°F, relative humidity from 10 to 100 percent, rain up to 25 inches per hour, wind, snow, icing, salt spray, sand, dust, and solar radiation. The advantages of having this variety of test environments in a single accessible location, particularly for such large systems as aircraft, are obvious.

A significant part of the infrastructure of the McKinley Climatic Lab is devoted to the temperature control system and the air flow control system, which allows aircraft and engines to be operated for up to 60 minutes while maintaining the desired environmental conditions. By virtue of its size and open area, personnel can perform normal operational, maintenance, and repair functions with normal support equipment in a full range of stressing operational environments. In addition to the main test chamber, the MCL has five smaller test chambers, one of which can also support aircraft engine operation.

The MCL completed a $100 million renovation in 1997. It is currently staffed to operate two of its six chambers simultaneously. Because of the large number of users desiring environmental testing, customers reimburse nearly 100 percent of MCL direct costs. The Air Force Advanced Cruise Missile and Air-Launched Cruise Missile (ACM/ALCM) program is a long-term user that has invested $30 million in the MCL to conduct its in-service reliability testing. The test facility allows it to operate the selected missile's propulsion system in various environmental conditions without having to expend the missile. This preserves an expensive weapon, which can then be refurbished and returned to service.

Customers

Table 4.8 lists the customers scheduled for the MCL after October 1, 2006.

Alternatives

With the exception of small environmental chambers, the alternative to conducting climatic testing at the MCL is to attempt to find the required conditions in nature. While theoretically

[8] The information in this section is taken from communications with 46th Test Wing; AAC, 2006; TRMC, 2006c; AFMC, 2007b; Dyess, 2007f; and Dyess, 2007c.

Table 4.8
Affected MCL Customers, Schedules, and Closure Effects

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effects
MRA4 Nimrod	09/10–11/10	UK Ministry of Defence	5,904	41	Significant No alternative facility available worldwide
Chem/Bio Shelter	10/10–11/10	U.S. Air Force	1,296	9	Significant No alternative facility available worldwide
20mm Gun	10/10–10/10	U.S. Air Force	1,728	12	Significant problem for cost and schedule Could be done elsewhere
Chem/Bio Shelter	10/10–10/10	U.S. Air Force	1,152	8	Significant No alternative facility available worldwide
FMC Technologies Aircraft Cart	11/10–11/10	U.S. Air Force	1,008	7	Significant problem for cost and schedule Could be done elsewhere
Army Shelter (28 TS)	11/10–11/10	U.S. Army	720	5	Significant No alternative facility available worldwide
FAA Prop Icing	11/10–11/10	FAA Government	2,448	17	Significant No alternative facility available worldwide
Chem/Bio Shelter	11/10–11/10	U.S. Air Force	2,160	15	Significant No alternative facility available worldwide
Alaska Structures	11/10–11/10	U.S. Air Force	720	5	Significant No alternative facility available worldwide
Hamilton Sunstrand Auxiliary Power Unit	11/10–12/10	Commercial (Boeing 787)	1,728	12	Significant problem for cost and schedule Could be done elsewhere
PW545C Jet Engine	11/10–12/10	Commercial	3,744	26	Significant problem for cost and schedule Could be done elsewhere
Hamilton Sunstrand Auxiliary Power Unit	12/10–12/10	Commercial (Airbus A400M)	1,872	13	Significant problem for cost and schedule Could be done elsewhere
Honeywell HTS900 Engine	01/11–01/11	Commercial (Sikorsky helicopter)	3,168	22	Significant problem for cost and schedule Could be done elsewhere
Cruise Missile	01/11–02/11	U.S. Air Force (ACM and ALCM)	6,768	47	Significant No alternative facility available worldwide
Cessna Aircraft	01/11–02/11	Commercial	2,016	14	Significant No alternative facility available worldwide
PW617 Jet Engine	02/11–03/11	Commercial	5,040	35	Significant problem for cost and schedule Could be done elsewhere
F-22	03/11–05/11	U.S. Air Force	6,624	46	Significant No alternative facility available worldwide

Table 4.8—Continued

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effects
PW617 Jet Engine	04/11–04/11	Commercial	3,024	21	Significant problem for cost and schedule Could be done elsewhere
C-5	05/11–06/11	U.S. Air Force	6,624	46	Significant No alternative facility available worldwide
Cessna Aircraft	06/11–06/11	Commercial	864	6	Significant No alternative facility available worldwide
PW210 Jet Engine	06/11–09/11	Commercial	10,368	72	Significant problem for cost and schedule Could be done elsewhere
Williams International Jet Engine	09/11–09/11	Commercial	3,024	21	Significant problem for cost and schedule Could be done elsewhere
PW535 Jet Engine	09/11–11/11	Commercial	6,192	43	Significant problem for cost and schedule Could be done elsewhere
Cessna Aircraft	10/11–10/11	Commercial	1,008	7	Significant No alternative facility available worldwide
PW210 Jet Engine	10/11–11/11	Commercial	4,896	34	Significant problem for cost and schedule Could be done elsewhere
C-130	11/11–12/11	U.S. Air Force	4,752	33	Significant No alternative facility available worldwide
Cruise Missile	See note	U.S. Air Force (ACM and ALCM)			Significant No alternative facility available worldwide
CH-148 Helicopter	01/08–2/08	Commercial (S-92 Variant)	7,200	50	Significant No alternative facility available worldwide
THAAD	03/12–05/12	U.S. Army	12,960	90	Significant No alternative facility available worldwide
Honeywell HGT1500 APU	01/13–03/13	Commercial (Airbus A350)	12,816	89	Significant problem for cost and schedule Could be done elsewhere
JLENS	03/14–05/14	U.S. Army	8,784	61	Significant No alternative facility available worldwide
SAR Helicopter	06/14–07/14	U.S. Air Force U.S. Coast Guard	8,640	60	Significant; No alternative facility available worldwide
P-3 Replacement Aircraft	08/14–10/14	U.S. Navy	12,960	90	Significant No alternative facility available worldwide

Table 4.8—Continued

Customer	Dates	Type	Man-Hours	Project Days	Anticipated Effects
F-35	05/15–09/15	U.S. Marines U.S. Navy U.S. Air Force Internationals	19,440	135	Significant No alternative facility available worldwide

SOURCE: Dyess (2007f).

NOTE: The ACC Cruise Missile Product Group invested approximately $30 million in FYs 2005 and 2006 to develop a unique capability in MCL to conduct functional ground test of ACM and ALCM nuclear cruise missiles at the McKinley Climatic Lab. Tests are currently planned, and closure will negate much of this investment.

possible, the principal drawbacks of open-air testing are the time and travel costs for the test team, the system under test, and the instrumentation to get to remote locations and potentially having to wait to achieve the approximate test conditions. Test quality can also be compromised by the lack of control over naturally occurring conditions, singly or in combination.

The 46th Test Wing examined various alternatives to reducing costs at the MCL. The wing estimated that closing the facility would cost $25 million, primarily because of the requirement to dispose of thousands of gallons of hazardous materials (primarily refrigerants) and subsequent site decontamination. This would also preclude subsequent reactivation.

Another possibility considered was to mothball the facility so that it could be restored to operation at some future date. The 46th Test Wing estimated that the cost to mothball the MCL would be $3.5 million per year to retain the capability to resume normal operations within 6 months. The estimate for retaining any capability to restart was $2.1 million per year. This would allow minimal maintenance and preservation of the facility and equipment. This was the alternative AFMC chose and is shown in our cost analysis. (For comparison, the corresponding cost of operating the facility is given as approximately $1.5 million per year because of the high percentage of costs reimbursed by customers.)

Costs

RAND collected MCL cost and staffing data from the 46th Test Wing. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and for the AFMC proposal. For the purposes of this analysis, the facility was assumed to be in a mothball status per the AFMC proposal in FY 2007. The 46th Test Wing estimated an annual cost of maintaining the facility in a mothball status of approximately $2.1 million. The customer cost of $10 million to 46 million used to calculate the cost under the AFMC proposal was taken from the AAC study. These figures could not be independently verified.

As Table 4.9 shows, the annual cost of operating the MCL, exclusive of improvement and modernization projects, is approximately $1.5 million. The AFMC proposal plan results in a negative net savings because of the customer costs.

Conclusions

The MCL is the primary DoD facility for climatic testing. It can replicate a full range of environmental conditions and can accommodate large aircraft operating their engines and other installed systems. The variety of users who value this capability can be inferred from examining the MCL customer list in Table 4.8.

Table 4.9
MCL Cost Results (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	1,455	N/A	1,455
Status quo operation, FYs 2007–2011	7,794	17,500	25,294
AFMC proposal, FYs 2007–2011	10,627	130,000	140,627
Savings, FYs 2007–2011	(2,833)	(112,500)	(115,333)

The institutional funding required to operate this facility at its current capacity is approximately $1.5 million per year, which is, interestingly, less than the estimated annual cost of maintaining the facility in a mothballed but nonoperational state. Setting aside the difficult-to-quantify customer effect of either transitioning to open-air testing, testing at the component level only, or simply reducing climatic testing, it is clear that the financial benefits of closing or mothballing the MCL are negligible, and the risks to DoD and other users are considerable.

Seeker and Signature Test and Evaluation Facility

Description

The STEF is located on the range at Eglin AFB, Florida.[9] This open-air facility enables target signature measurement through its 300-ft seeker evaluation tower, stationary platforms, rail system with turntables, and 2,500-lb-capacity hoist that can move at a rate of 25 ft per second. In addition, the STEF permits testing with depression angles from 0 to 81.5 degrees. The STEF has an on-site data analysis system. This combination of equipment allows testing of air-to-ground seeker sensors on targets in all practical positions, including below ground level. This facility is an HITL evaluation center, permitting testing on full-scale targets for full characterization of IR, RF, and MMW signatures. The STEF is one constituent of the 46th Test Wing's portfolio that allows for full-spectrum signal analysis.

The STEF is directly supported by seven people, four civilians, and three contractors.

Customers

Table 4.10 lists the customers scheduled for the STEF after October 1, 2006.

Alternatives

No current facility offers the full range of precision measurement testing that is available at STEF. Unique to the STEF are the data collection on low-observable ground vehicles and the availability of Defense Intelligence Agency–Missile and Space Intelligence Center (MSIC)–validated calibration and processing software tools. The 2005 BRAC report recommended relocating these assets to Eglin, including the creation of an Air Integrated Weapons and Armament testing center including full-spectrum signal measurement capabilities.

[9] The information in this section is taken from communications with 46th Test Wing; AAC, 2006; TRMC, 2006c; AFMC, 2007b; and Dyess, 2007f.

Table 4.10
Affected STEF Customers, Schedules, and Closure Effects

Customer	Dates	Type	Man-Hours	Project Days
ACC—IR	10/05–09/08	DoD	2,100	75
ACC—MMW	10/05–09/08	DoD	10,368	384
MALD Phase II—MMW	04/07–08/07	DoD	378	14
MSIC—IR	10/05–09/08	DoD	840	30
MSIC—MMW	10/05–09/08	DoD	3,807	141
NASIC—IR	10/05–09/08	DoD	2,520	90
NASIC—MMW	10/05–09/08	DoD	1,620	60
NGIC—IR	10/05–09/08	DoD	1,260	45
NGIC—MMW	10/05–09/08	DoD	1,620	60
SDB—MMW	01/07–09/07	DoD	378	14
SFW—IR	10/05–09/08	DoD	840	30

SOURCE: Dyess (2007f).

NOTE: In all cases, closure will affect the customer's concept of operations, costs, schedule, and test fidelity.

The NAWCWD facilities at Etcheron Valley, China Lake, have some capability to perform a subset of the activities found at the STEF. According to NAWCWD, the additional capabilities required to assume the STEF workload are a 100-ft tower, Ka- and W-band radars, and IR hardware, some of which could be relocated from the STEF. TRMC concluded that there would be considerable costs to the Army stemming from the need to deploy for all tests.

The Army Electronic Proving Ground at Ft. Huachuca is listed as another potential alternative. The White Sands facility, as noted by TRMC, is smaller, provides limited ability to cover all angles of air-to-ground target positioning, and has no extended track for constant-distance measurements.

Costs

The 46th Test Wing provided cost and staffing data for the STEF. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and for the AFMC proposal. For the purposes of this analysis, the facility was assumed to be shut down in FY 2007 and moved to the Etcheron Valley Range (EVR) at China Lake. The 46th Test Wing estimated the shutdown cost as $1.8 million. The NAWC estimate listed the modifications required at EVR to accommodate the STEF workload. The 46th Test Squadron had developed an estimate to rebuild the STEF in a new location. By taking the NAWC list of activities and comparing its estimates with estimates of similar activities by the 46th Test Wing, RAND derived an estimate of $1.5 million to reconstitute the STEF capabilities at EVR. The customer faces an additional consequence, $17.5 million, for not having access to the facility, which is what was used in the AFMC proposal estimate and was taken from the

first STEF post-shutdown year estimate in the AAC study. This figure could not be independently verified and probably represents an upper bound.

As Table 4.11 shows, the annual cost of operating the STEF, exclusive of improvement and modernization projects, is approximately $0.5 million. The AFMC proposal plan results in a negative net savings because of the low cost of operating the STEF and customer consequences.

Conclusions

The STEF provides essential support to the weapon development community at a relatively low cost, so there is no compelling reason to relocate it. If other activities were to be removed from Eglin such that the synergies were lost, it could possibly be argued that it should be located to best serve the majority of its users.

Benefield Anechoic Facility

Description

The Benefield Anechoic Facility (BAF) is the world's largest anechoic chamber.[10] The main chamber measures 264 by 250 by 70 ft and can accommodate all current U.S. aircraft, except for the C-5B, or up to four smaller aircraft simultaneously. It is equipped with a 125-ton turntable and two 40-ton ceiling-mounted hoists. The BAF also has a smaller anechoic chamber for component testing.

Its primary functions are testing installed electronic-warfare systems, integrated avionics, tactical weapons, and their host platforms. It can provide a dense, representative electromagnetic environment, including simulated integrated air defense systems. It can also support evaluation of electromagnetic interference, electromagnetic compatibility, and antenna radiation patterns. It can link with AFEWES, IFAST, and the western test ranges. It and J-PRIMES are the only Air Force anechoic chambers that can accommodate full-size aircraft.

Customers

Figure 4.2 shows the number of test days the BAF supported in FYs 2000 through 2006. In FY 2006, the BAF provided a high of 199 test days to 16 customers. Table 4.12 shows the distribution of each type of testing during 2006. Table 4.13 shows the planned BAF customers through FY 2011. Table 4.14 shows the estimated BAF workload in test days through 2011.

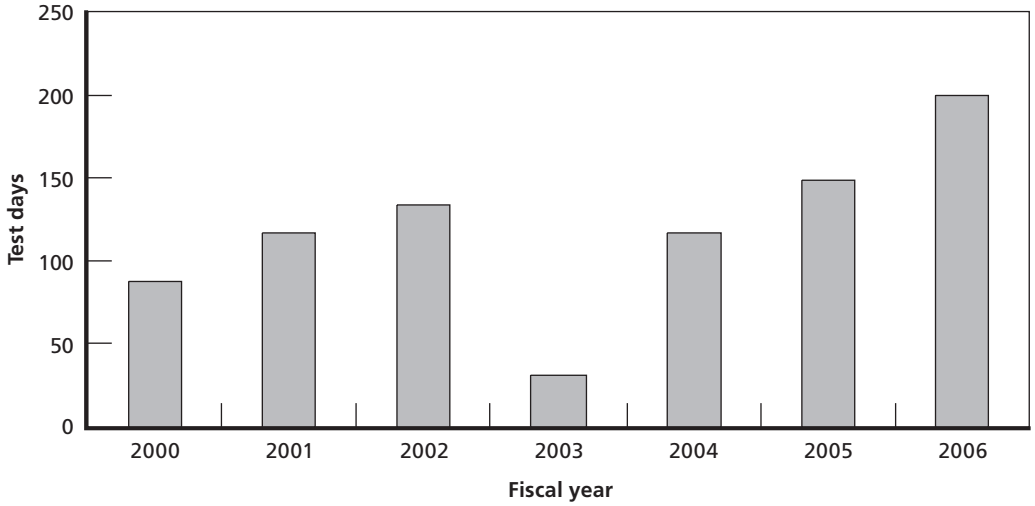
The 412th Test Wing estimates that the proposed PBD-720 reductions ($7.8 million, partially offset by 36 additional civilian positions transferred from activities to be closed at Eglin) to the BAF would reduce throughput by approximately 40 percent, e.g., from the FY 2006 level of 199 test days to approximately 151 test days. However, as shown in Table 4.14, these cuts have a smaller effect on the current projections for FY 2008–2011. Other effects of this cut would be to eliminate test capabilities for IR and ultraviolet systems and to limit the ability to test sensor fusion. Communications, navigation, and identification capabilities would also degrade to nil over three to five years. According to the 412th Test Wing, this would have a

[10] The information in this section is taken from communications with 412th Test Wing; TRMC, 2006f; and AFMC, 2007b.

Table 4.11
STEF Cost Summary (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	467	N/A	467
Status quo operation, FYs 2007–2011	2,483	4,263	6,746
AFMC proposal, FYs 2007–2011	3,571	21,763	25,334
Savings, FYs 2007–2011	(1,088)	(17,500)	(18,588)

Figure 4.2
BAF Test Days



NOTE: BAF was closed for much of 2003 for installation of the Electronic Combat Integrated Test capability.

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Table 4.12
BAF FY 2006 Workload by Type

BAF Test Type	Days
Radar warning receiver	93
Calibration	46
Electromagnetic interference, compatibility, and environmental effects	32
Antenna pattern	15
Communications, navigation, and identification	13
Total	199

major effect on the Air Force's ability to support network-centric warfare testing on advanced platforms, such as the F-22A and F-35.

Alternatives

The primary alternative to the BAF is the ACETEF at the Naval Air Warfare Center–Aircraft Division, Patuxent River, Maryland. It has a smaller chamber (180 by 180 by 60 ft)

Table 4.13
BAF Customer Projections Through FY 2011

BAF Projected Customers	FY 2007, Quarter 1	2	3	4	FY 2008	FY 2009	FY 2010	FY 2011
MC-130E ALR-69A PLAID	X							
400-Hz converter calibration	X							
F-16 ALR-69A troubleshooting	X							
Installed Test Integration Program (ITIP) IP #16 chamber Temporary Secure Working Area	X							
NASA F-15 antenna pattern		X						
F-16 ALR-69A Precision Location and Identification		X						
Global Hawk RQ-4A Block 10		X						
B-1B ALQ-161 PFS 5.3 test		X						
C-130J ALR-56M		X						
AFOTEC IFF-Mode 5		X						
X-51 Boeing SED Wave Rider			X	X				
DARPA Retro-Directive Ultra-Fast Acquisition Sensor (special access program)			X					
B-52 MALD/MALD-J			X					
UK Trial Smash 6 Typhoon			X					
RF Phenomenology II			X	X				
F-16 Sniper POD video test acceleration				X				
Bavarian Motor Works (BMW) Electromagnetic Environmental Effects (EEE)				X				
F-16 Block 40 Mode S IFF integration				X				
B-1B PACU replacement					X			
BMW EEE					X			
C-17 Block 18 EEE					X			
DARPA I (special access program)					X			
DARPA II (special access program)					X			
F-22A CNI					X			
Global Hawk RQ-4A EEE					X			
ITIP chamber TSWA					X			
Joint Tactical Radio System (JTRS) radio					X			
F-16 MALD/MALD-J					X			
REAPER MQ-9 EEE/CNI					X			
Special access program					X			
UK Trial Smash Typhoon					X			
B-1B JTRS I&I MN-6881						X		
B-1B targeting pod						X		
B-52 radar warning receiver						X		
BMW EEE						X		
C-130J large-aircraft IR						X		
C-17 Block 19 EEE						X		
CSAR-X EEE						X		

Table 4.13—Continued

BAF Projected Customers	FY 2007, Quarter 1	2	3	4	FY 2008	FY 2009	FY 2010	FY 2011
DARPA (special access program)						X		
F-22A sensor fusion						X		
F-35 EEE						X		
Global Hawk RQ-4A EEE						X		
ITIP chamber TSWA						X		
UK Trial Smash Typhoon						X		
Advanced EW T&E capability							X	
B-1B ALQ-161A advanced tracker							X	
B-1B ALQ-161A waveform generator							X	
C-17 Block 2 EEE							X	
CSAR-X ANT PAT/RWR							X	
DARPA (special access program)							X	
E-10 EEE							X	
F/A-22 advanced communication system							X	
F-22A JTRS I&I							X	
F-35 sensor fusion							X	
REAPER MQ-9 EEE/CNI							X	
UK Trial Smash Typhoon							X	
Advanced EW T&E capability								X
B-52 RWR								X
C-17 Block 21 EEE								X
CSAR-X ANT PAT/RWR								X
DARPA (special access program)								X
E-10 EEE								X
F/A-35 advanced communication system								X
F-22A sensor fusion								X
F-35 JTRS I&I								X
F-35 sensor fusion								X
REAPER MQ-9 EEE/CNI								X
UK Trial Smash Typhoon								X

Table 4.14
BAF Projected Workload

	FY 2008	FY 2009	FY 2010	FY 2011
Available time (test days)	252	252	252	252
BAF customer demand (test days)	120	155	170	140
Capacity utilization (%)	48	62	67	56

and therefore cannot accommodate bomber or large transport-sized aircraft. It does, however, have an additional fighter-sized chamber. Its lack of a turntable and its smaller size limit its ability to measure far-field effects. Its location makes it practical to use for pre- or post-flight testing only for tests conducted on the local range. According to TRMC, it is currently operating near capacity and has limited surge capability without additional facilities.

A partial alternative to the BAF is J-PRIMES at Eglin AFB. Its suitability as a substitute for the BAF is limited by its smaller size and more-limited threat-presentation capabilities. For geographic reasons, it is impractical to use for pre- and post-flight checkout for anything other than local flight testing.

Another partial alternative to the BAF is open-air testing. The drawbacks are higher cost, lower test efficiency, lack of environmental control, and inability to provide a high-density, threat-representative electronic environment.

Costs

RAND collected BAF cost and staffing data from the 412th Test Wing. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and for the AFMC proposal. For the purposes of this analysis, the staffing cuts associated with the AFMC proposal were taken in FY 2008.

As Table 4.15 shows, the annual cost of operating the BAF, exclusive of improvement and modernization projects, is approximately $21 million. The AFMC proposal plan results in a net savings because of the reductions in capability and associated modernization projects.

Conclusions

Unlike the other facilities discussed in this section, the PBD-720 proposal reduced BAF contractor support funding but did not close or divest the facility. Although the IR-ultraviolet and sensor fusion test capabilities would be eliminated and although the CNI capability would likely atrophy, the BAF could continue to support its approximate projected workload, assuming it received the additional civil service positions. It could not, however, assume the work from J-PRIMES at the reduced funding level.

Table 4.15
BAF Cost Summary (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	20,783		20,783
Status quo operation, FYs 2007–2011	192,646	10,133	202,779
AFMC proposal, FYs 2007–2011	186,514	10,133	196,647
Savings, FYs 2007–2011	6,132	0	6,132

National Full-Scale Aerodynamic Complex

Description

The NFAC is a large wind-tunnel facility with two tunnels sharing a common drive system.[11] The 40-by-80-ft tunnel was completed in 1944 and is a continuous flow design. It is designed for speeds up to 300 knots and rated for 250 knots. The 80-by-120-ft tunnel was completed in 1982 and is a blow-down design. It is the world's largest wind tunnel and is designed for 100 knots and rated at 80 knots. Both tunnels are acoustically insulated. They are primarily used for rotorcraft and fixed-wing, high-angle-of-attack aircraft testing. Having access to a tunnel of this size is particularly important for rotary-wing development because the aerodynamic and aeroelastic properties of rotors are complex and are not well modeled by subscale testing or computational fluid dynamics. NFAC is the only wind tunnel that can accommodate full-scale rotorcraft.

NFAC is part of NASA's Ames Research Center in Mountain View, California. In 2003 NASA decided to mothball the NFAC, along with a 12-ft tunnel. DoD was concerned that it would lose a test resource vital for rotorcraft development and considered various options to preserve the NFAC. In February 2006, the Air Force signed a lease with NASA to allow it to operate the NFAC. The lease agreement stipulates that NASA retains ownership of the facility and that either side can cancel the lease with six months' notice.

An AEDC detachment operates the NFAC. Staffing is one Air Force officer, three Army-funded personnel, five NASA employees with NFAC experience, five consultants, and 25 contractors. Additional AEDC and NASA personnel provide support as necessary. Current activity focuses on completing the new data system for the 40-by-80-ft tunnel, restoring the supporting subsystems to operational condition, and testing operation. The schedule of activities is shown in Figure 4.3.

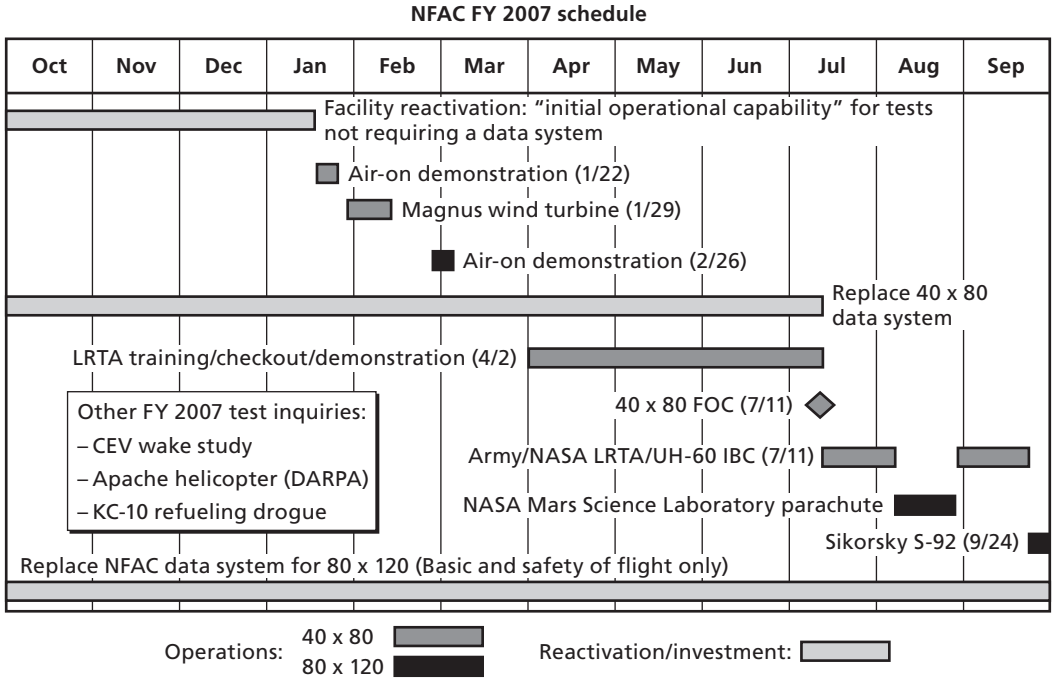
Customers

Since the NFAC is in the process of reactivation and since it has not been operating for a number of years, securing customers is an ongoing process. The NFAC commander provided the following list of prospective customers:

- Near-Term Schedule (< 2 years)
  - NASA Mars Parachute (80 × 120)
  - Sikorsky S92 Cross-Wind Starts (80 × 120)
  - Air Force Airborne Icing Tanker Spray Array (40 × 80)
  - Formal Test Requests Received from Army:
    - UH-60 Individual Blade Control (Large Rotor Test Apparatus [LRTA], 40 × 80)
    - UH-60 Scaling (LRTA, 40 × 80), Fall 2007
  - Japanese Wind Turbine (40 × 80)
- Possible Near-Term Tests (< 3 years)
  - Defense Advanced Research Projects Agency (DARPA) Heliplane Slowed Rotor (40 × 80)
  - DARPA Heliplane Airframe (40 × 80)

[11] The information in this section is taken from the communications with NFAC personnel; TRMC, 2006a; AFMC, 2007b; and Arnold Engineering Development Center, 2006a.

Figure 4.3
NFAC FY 2007 Schedule



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  - Army/Boeing SMART Rotor (40 × 80)
  - Army Active Elevon Rotor (40 × 80)
  - Air Force AMC-X (40 × 80)
  - Navy UH-1Y and UH-1Z Blade Fold (80 × 120)
  - Navy V-22 Departure Resistance (40 × 80)
  - Navy F/A-18 E/F High Alpha (40 × 80)
  - Navy CH-53X (40 × 80)
- Longer-Term Potential Tests (3–5 years)
  - DARPA Helicopter Quieting Program (40 × 80)
  - DARPA TR-40 Rotor (40 × 80 and 80 × 120)
  - DARPA TR-80 Rotor (80 × 120)
  - DoD Joint Heavy Lift Rotorcraft
  - Navy Growth V-22 Rotor (40 × 80)
  - NASA Fundamental Rotor Aerodynamics (40 × 80)
  - NASA Active Rotor Aeromechanics (40 × 80)
- Possible Near-Term Tests (< 3 years)
  - DARPA Heliplane Slowed Rotor (40 × 80)
  - DARPA Heliplane Airframe (40 × 80)
  - Army/Boeing SMART Rotor (40 × 80)
  - Army Active Elevon Rotor (40 × 80)
  - Air Force AMC-X (40 × 80)
  - Navy UH-1Y and UH-1Z Blade Fold (80 × 120)
  - Navy V-22 Departure Resistance (40 × 80)

  - Navy F/A-18 E/F High Alpha (40 × 80)
  - Navy CH-53X (40 × 80)
- Longer-Term Potential Tests (3–5 years)
  - DARPA Helicopter Quieting Program (40 × 80)
  - DARPA TR-40 Rotor (40 × 80 and 80 × 120)
  - DARPA TR-80 Rotor (80 × 120)
  - DoD Joint Heavy Lift Rotorcraft
  - Navy Growth V-22 Rotor (40 × 80)
  - NASA Fundamental Rotor Aerodynamics (40 × 80)
  - NASA Active Rotor Aeromechanics (40 × 80)
  - NASA UH-60A Airloads Wake Study (40 × 80)
  - NASA Tilt Rotor Interactional Aerodynamics (40 × 80)
  - NASA Aeroacoustics (40 × 80)
  - Boeing Large-Scale Transport with Active Flow Control (40 × 80).

Alternatives

Other wind tunnels are available, but none of the size of NFAC, including the following:

- NASA Langley 30 × 60 tunnel (managed by Old Dominion University)
- Boeing 20 × 20 tunnel (Philadelphia)
- NASA Langley Transonic Dynamics Tunnel and 14 × 22 tunnel
- Lockheed Martin 16 × 23 tunnel (Marietta)
- NASA Ames 7 × 10 wind tunnel (operated by the Army)
- Various European tunnels.

Of course, another alternative is flight testing, at additional cost and risk.

Costs

NFAC's director provided cost data and a hypothetical closure plan. These data were analyzed and used to develop costs for continuing operations as currently planned (status quo) and divestiture in FY 2007 under the AFMC proposal. The director estimated the costs of terminating contracts and accomplishing other divestiture tasks, depending on when the closure decision was made. For the purposes of this analysis, we assumed a decision to divest would have been made in April 2007. There was no estimate available of the customer consequences of an NFAC shutdown.

As Table 4.16 shows, the annual cost of operating the NFAC, exclusive of improvement and modernization projects, is approximately $11 million. The AFMC proposal plan for divestiture results in a net savings of $46 million across the FYDP. However, these savings do not reflect any effects on future customers or the cost for another agency to continue NFAC operations, which would reduce the savings shown.

Conclusions

Several recent studies have concluded that NFAC is an important national asset (Anton, 2004; Madl, 2004). DoD has concluded as much by providing the initial funding to the Air Force to reactivate the facility. The anomaly is that the most likely users of the facility are the Army and,

Table 4.16
NFAC Cost Summary (FY 2007 $000)

	AFMC	Customers	Total
Average annual recurring DBA	11,039	N/A	11,039
Status quo operation, FYs 2007–2011	49,185	19,400	68,585
AFMC proposal , FYs 2007–2011	2,783	19,400	22,183
Savings, FYs 2007–2011	46,402	0	46,402

to a lesser extent, NASA and other non–Air Force programs. As long as users paid a significant share of the costs of operating T&E facilities, this was not a particularly significant issue. However, with the revised charging policies directed by NDAA 03, the Air Force must now fund a test facility that predominately addresses the needs of other services for the foreseeable future. This dilutes the role of the "discipline of the market" in setting investment priorities.

Facilities Summary

In considering the advisability of the proposed PBD-720 reductions to the T&E infrastructure, it is important to keep the cost savings in perspective. In most cases, the cost of maintaining these facilities is a relatively small investment to ensure that test capability and capacity are available when needed to reduce program risk and avoid potential schedule delays, the consequences of which could be much larger than the anticipated savings. In nearly every case, the facility cuts proposed would increase risk and at least near-term costs to DoD programs.

In the case of the NFAC, the Air Force pays the bulk of the costs of maintaining the facility, but the primary customers are distinctly non–Air Force. The appropriateness and advisability of a DoD component providing funding support in these circumstances should be carefully evaluated. Given that the NFAC is the only facility that can support full-scale rotorcraft wind-tunnel testing, this evaluation should be conducted as a policy, rather than budgetary, issue.

If there are lessons to be learned from this experience, it is that substantial realignments of T&E infrastructure should be done as part of a carefully considered and coordinated plan. No category of expenditures should be off limits to informed debate and competition for what will always be limited resources, but when the probability of unintended consequences is high, accurate information and full consideration of all stakeholders' interests becomes imperative.

Our findings relative to the proposed facilities actions are summarized in Table 4.17.

Table 4.17
Summary of Facilities Findings

Facility	AFMC-Proposed Action	RAND Findings	Comments
CIGTF	Close or divest	Retain	No practical alternatives Broad customer base
GWEF	Close or divest	Retain	Insufficient alternative capacity
J-PRIMES	Close or divest	Consider divesting to Army if flight testing moves	Low cost Should be collocated with range
MCL	Mothball	Retain	Unique capability High usage Low cost
STEF	Close or divest	Retain	Low cost
BAF	Reduce	Restore if J-PRIMES divested and/or to retain network-centric test capability	Sole Air Force full-size anechoic chamber if J-PRIMES divested
NFAC	Close or divest	Consider divesting to Army	Not related to core Air Force mission (Policy decision)

CHAPTER FIVE

Conclusions

Our CBA focused on the three major provisions of AFMC's proposal: the consolidation of the 46th and 412th Test Wings, reductions in the ground and open-air test ranges at Eglin AFB, and the divestiture or reduction of seven test facilities. We note that the AFMC proposal had more detail on the facilities part of the proposal than on the consolidation and range aspects. Our analysis took account of cross-connections among the three parts of the proposal to ensure that we considered how the effects of decisions in one area might affect another.

Consolidation

We analyzed the cost-benefit effects of consolidation in three areas: the FHP for the 46th and 412th Test Wings, the consolidation of the maintenance of the 46th and 412th Test Wings, and the merging of the test wing support structures. The results of our analysis show a savings of $43.2 million over the FY 2007–2011 FYDP. With respect to maintenance consolidation and the staff support functions, we also show the effect on the currently combined functions with the 53rd Wing.

There are, however, other considerations. With respect to backshop maintenance, the bulk of the maintenance personnel who remain at Eglin are contractors, and the bulk of those transferring to Edwards are enlisted personnel. This means, in part, that Edwards will have to recruit additional civilian workers, and this process will require time and additional resources. With respect to flightline maintenance, most individuals transferring to Edwards are again enlisted personnel, but most maintenance personnel at Edwards are civilians. This will alter the composition of the workforce, which may affect Edwards' HPO maintenance approach. The Air Force will need to consider such consequences before implementing a proposal to merge the wings.

Ranges

With respect to ground ranges, we analyzed eight facilities that were primarily dedicated to range ground tests. In its original proposal, AFMC had not intended to close any facilities beyond those explicitly identified among the original options. Because of that, AFMC was unaware that reducing the range capacity would force the shedding of range ground capabilities—RAND uncovered these potential effects during the early stages of the CBA. Our findings can be categorized in three ways:

1. Some facilities are clearly not cost-effective to close, either because they are unique or because the savings garnered by closing them would be minimal, especially when other program costs are taken into account.
2. Closing some facilities may make economic sense.
3. Others might also make economic sense to close, but more data are needed to make an informed judgment.

The ones that make economic sense to close are the Seeker/Sensor/Signature Evaluation Facility and the Static Munitions Test Arenas. Closing these facilities may yield FYDP savings of $9.5 million. Closure will likely generate some additional program costs, which will reduce these savings. Closing the Base Installation Security Systems and the HELLFIRE Test Facility might generate some savings, but we do not have enough data about how these closures might affect customers to make an informed judgment. These facilities could also be transferred to the programs that use them, but in that case, there would be no net savings to DoD.

With respect to OAR flight-test activities, we project a savings of $149 million over the FY 2007–2011 FYDP.[1] To inform this assessment, several stakeholders from Eglin AFB, Edwards AFB, NAWC China Lake, and NAWC Point Mugu met to understand what types of flight operations could be conducted if OAR activities moved from Eglin to the western test ranges (WTR). This exercise specifically addressed capability (not range capacity) and was predicated on 17 weeks of actual flight testing at Eglin. The stakeholders' results showed that Edwards AFB and its range could not support the entire Eglin workload of this 17-week period. However, the combined capabilities of the WTR—specifically, Edwards, the Point Mugu sea range, and China Lake—could support almost all the Eglin workload, except possibly the telemetry. In the exercise, all the sorties were launched from Edwards. Sixty percent of the missions could be completed with Edwards capabilities alone. Twenty percent required support from the Point Mugu sea range, and another 19 percent required support from China Lake, Edwards AFB, and the R-2508 complex. About 1 percent required support from other ranges, such as White Sands Missile Range. Moving the Eglin open-air developmental testing would provide an opportunity for the Air Force to save substantial resources. These savings come from (a) test wing staff consolidation and (b) increased OAR efficiency.

The range activities cannot be shifted to the WTR in isolation or without risk. Movement of the OAR flight testing to the WTR must be linked with the consolidation of the 46th and 412th Test Wings, and in this light, the costs and benefits of range consolidation and wing consolidation can only be considered together. Wing consolidation can succeed only if the Navy supports expanded Air Force activity at the western Navy ranges. This consolidation of both wing and OAR flight-test activities would require significant planning and coordination to minimize the effects on the customers.

Facilities

Our analysis of the seven facilities outlined in the AFMC proposal leads us to conclude that the Air Force should not divest itself of these facilities, with two exceptions: NFAC and J-PRIMES. NFAC, a wind tunnel, is a specialized facility that few Air Force customers use and that has

[1] See Table C.12.

little direct benefit for the Air Force. J-PRIMES allows an aircraft with radio frequency sensors and emitters to be tested against a simulated threat environment to exercise new and updated software. It is relatively inexpensive and is valuable for Army testing and flight-test programs at Eglin. Assuming most flight testing migrates to the WTR, it would make sense for the Air Force to transfer what activities it carries out at J-PRIMES and transfer J-PRIMES to the Army. For the other five facilities considered, we concluded that either (1) the facilities were too unique to allow their closure and there was no adequate substitute or (2) customer costs would likely outweigh any savings if the facilities were closed.

Risk

Throughout this document, we have highlighted potential risks to the Air Force and DoD of implementing the AFMC proposal. In the aggregate, these risks are not trivial and indicate that the Air Force needs to refine alternatives further and needs to understand how customers, test organizations, and DoD will be affected. When possible, we included relevant customer effects, in terms of the costs programs may incur. Admittedly, these costs did not include those for classified programs—more analysis and a change in the classification of this document would have been required to consider them.

We also discussed the risks associated with the consolidation of the 46th and 412th Test Wings and the transfer of OAR flight-test activities to the WTR. In both cases, significant coordination would be required to prevent testing from being hampered. The Air Force would need to work out details on how to merge the wings effectively. At the time we conducted this study, the details were not fully refined. Similarly, this effort would require a thorough examination of the types of personnel required, as well as the selection of best practices for testing programs and maintaining and flying aircraft. With respect to the OAR, the Air Force would need to work closely with the Navy to ensure the equitable availability of time on the range schedules at Point Mugu and China Lake. Although Air Force personnel at Edwards AFB routinely work with Navy colleagues to coordinate airspace and range activities in the WTR, the amount of OAR flight-test activities that the AFMC proposal would transfer would require a purposeful approach to ensure that test activities can be accomplished.

As the Air Force looks to the future, there is a broader concern with respect to the risk that the service may incur by divesting itself of T&E infrastructure. If facilities or ranges are divested, the Air Force would be eliminating its capability to conduct future developmental testing at various locations. This in turn could lead to one of two possible outcomes:

1. greater reliance on contractors in the longer term for developmental testing, which could possibly offset savings from divestiture or consolidation
2. fewer tests, which could increase a program's risks over its life cycle.

One of the goals of T&E is to find ways to do better and more-realistic developmental testing earlier to avoid problems later. It is possible that consolidation or divestiture could move the Air Force in the opposite direction, with more reliance on contractors and less-insightful developmental testing overall.

Limitations of This Analysis

As a significant caveat to our work, the results presented in this monograph are driven primarily by cost considerations. We do not attempt the difficult task of quantifying the value of benefits that would be forgone. For example, the Air Force might find it requires more testing in the future at a specific facility or range. If that capacity were already in maximum use or no longer existed, the effects on programs and their ability to test would be significant.

We could not objectively quantify the potential for future operational surges or other associated benefits, such as increased capacity, that are available to the Air Force today. RAND's findings about cost are driven primarily by data and estimates from the Air Force and from other government sources that we contacted and interviewed for this work. In many cases, we were not able to assess the quality of inputs into the cost estimates and savings estimates that were provided to us. As previously stated, we used a series of repetitive inquiries to stakeholders and triangulated across data sources and interviews to develop a more-complete picture for the analysis.

Because of the general uncertainty of the details of parts of the AFMC proposal, it was not uncommon for the test organizations to provide updated inputs to us as further consideration matured their thinking about possible consequences. We expect that, with more time and further study of this subject, the test enterprise will be able to continue to refine plans and alternatives.

All the data that was collected and presented in this analysis are unclassified. The AFMC proposal, as stated, addressed programs that were considered to be unclassified. We did not include consequences for classified programs or for facilities that address classified T&E activities. Consideration of how these programs would be affected would likely indicate that the Air Force will face higher costs and risks if the AFMC proposal were implemented.

Finally, we emphasize that not all the cost savings identified in the analysis should be interpreted as being available to meet the $371 million budget decrement that PBD-720 imposes on AFMC T&E over the FY 2007–2011 FYDP. In some cases, the savings are in fact available to be taken without imposing burdens elsewhere in the DoD budget. In other cases, however, the AFMC proposal may allow the AFMC T&E to meet its savings goal by shifting the burden elsewhere in the Air Force or DoD.

Summary

In sum, analysis shows that the FYDP savings support consolidation of the 46th and 412th Test Wings discussed earlier. The wing consolidation would involve a substantial amount of effort, and more-detailed planning would be needed to ensure that all parties involved understood the plan and the sequence of events. The effects on the Eglin range are mixed. The demand for use of the ground-test ranges and the consequences for customers if the ranges are closed indicate that the ranges should remain open or be transferred to other services. The analysis of OAR flight testing shows potential savings over the FY 2007–2011 FYDP, but transferring the flight-test activities would require considerable coordination between the Air Force and the Navy and could affect a myriad of other users. It is important to note that the consolidation of the 46th Test Wing and the OAR must be linked—that is, one cannot be done without the

other. Analysis of the facilities shows a continuing need for them but not in all cases a need for the Air Force to control them.

The financial savings associated with both the consolidation and the transfer of the open-air flight testing from Eglin to the WTR must be tempered according to the type and amount of risk that the Air Force is willing to accept from the AFMC proposal. These risks are not trivial and include potential schedule delays for program testing, increased customer costs, and decreased T&E capacity. When possible, we have examined how the plan would affect customers but were limited by time and an inability to verify all potential consequences for customers. Many of these risks require further study and could not be captured within the constraints of this analysis.

APPENDIX A

Flight-Test Consolidation Scheduling Exercise[1]

1.0. Overview

1.1. When: 30 Jan 07—3 Feb 07
1.2. Where: Edwards AFB
1.3. Participants:

- Gary "Weso" Wesolowski (46 RANMS—Chief, Range Scheduling Flight)
- Maj. Dave Winebrener (780th TS—FTE)
- TSgt Dan Rivers (46 RANMS—Spectrum Managers)
- Mr. Terry Lawton (412th OSS/OSR—Chief of Range Scheduling)

1.4. Purpose:

- Ascertain the most probable distribution (by percentage) of 46 Test Wing flight-test workload between Edwards and the Navy ranges (Pt. Mugu & China Lake)
- Ascertain what percentage of 46 Test Wing flight-test workload would the Edwards range complex be able to work into their schedule.

2.0. Workload Distribution

We analyzed 17 weeks of scheduled 46 Test Wing flight-test missions taken from FY 2006. Mission activity was the primary driving factor on where the test had to be conducted. Large weapon footprint missions and missions requiring threat emitters needed to go to China Lake, SEEK EAGLE missions with test points below 5,000 ft mean sea level would need to go to Pt. Mugu, etc. The 17 weeks of data (see Tab A) consisted of a total of 357 missions. 19.07 percent needed to go to Pt. Mugu (see Tab B), 18.48 percent needed to go to China Lake (see Tab C), 60.22 percent could be done at Edwards, and 2.23 percent would need to go to other ranges primarily due to full-scale drone support. Table A.1 presents this data.

[1] This appendix reproduces a report by William Dyess and Gary Wesolowski, "Consolidation Scheduling Exercise," Eglin AFB, Fla., February 2, 2007. It is included to provide background and visibility into our analytic process. This is not a RAND document. Its conclusions are not the final conclusions of our analysis. Our complete analysis is partly based on important information not available to the authors of this attachment at the time it was written. Other than formatting and layout, the material is presented as received.

Table A.1
46th Test Wing Representative Flight Test Workload Spread Across the Western Ranges in Accordance with the Criteria

Week No.	Total Msns	China Lake		Pt. Mugu		Edwards	
		No.	%	No.	%	No.	%
1	17	7	41	3	18	6	35
2	25	10	40	2	8	13	52
3	17	8	47	2	12	7	41
4	23	5	22	4	17	14	61
5	21	3	14	5	24	13	62
6	25	3	14	6	23	15	59
7	35	6	17	5	14	24	69
8	31	5	16	5	16	20	64
9	29	3	10	3	10	22	76
10	21	2	10	4	19	15	71
11	17	3	18	3	18	9	53
12	14	3	21	5	36	6	43
13	19	0	0	8	42	11	58
14	16	2	12	2	12	11	69
15	14	1	7	4	29	9	70
16	17	2	12	3	18	12	70
17	16	2	12	4	25	8	50
Totals	357	65	18.48	68	19.07	215	60.22

3.0. Edwards' Ability to Absorb Workload

3.1. Introduction

A preliminary meeting between the organizations last summer concluded that there were five elements which might become limiting factors in the ability of Edwards AFB and the Navy to absorb the 46th Test Wing workload. These were mission control facilities, manpower, spectrum, physical space, and priorities. Manpower, for this exercise, was assumed to be sufficient to conduct the tests in order to concentrate on the scheduling aspect. The other four will be discussed below.

3.2. Mission Control

412th range personnel believe that control room availability was a manpower issue as they currently have 3 control rooms in mothball status. The anticipation was that should 46 TW flight testing be moved to Edwards AFB, those rooms would be manned and available to use. Since the current capability at Eglin AFB is to conduct a maximum of three missions at one time, we

determined that mission control room availability would not be an issue, as long as the plus-up of manning was realized.

3.3. Spectrum

The western ranges utilize the Integrated Frequency Deconfliction System (IFDS) to schedule and deconflict the spectrum for the entire region to include Pt. Mugu, China Lake, and Edwards. We were able to obtain 7 weeks of actual S-band frequency utilization data from this system. We then took 7 weeks of 46 TW historical mission data and attempted to schedule the TM requirements using the IFDS daily schedules. Keep in mind that the Edwards schedulers often "massage" this schedule in order to get additional missions on their schedule, something we did not have time or resources to do. We felt that this was offset by the fact that the IFDS historical data did not reflect any missions that canceled and fell off of the schedule. Of the 131 46 TW missions in the 7 weeks of data that required TM, 42 were identified as not being able to be scheduled due to frequency availability. The primary area of concern here is the S-band (upper and lower)

3.4. Physical Space

Airspace is not deconflicted within the Edwards range complex (except for some specific areas), thus that was not addressed. What level of workload could be absorbed in this environment is not proven. However, there seemed to be no concern over this increase in workload over their range or in the additional traffic that the China Lake and Pt. Mugu–bound aircraft would add.

3.5. Priorities

We did not look at priorities because the process is somewhat different at Edwards. While it does use an AF Precedent Rating as a guideline, it also attaches a local "urgency" code, which could artificially raise or lower the priority. In some cases, it could result in a 2-01 priority being rated higher than a 1-05 priority, depending on the urgency code. We also did not look at how the Navy will handle priorities of AF tests.

4.0. Summary and Findings

- Between 20 percent and 30 percent of the combined workload will not be able to be executed due to spectrum issues.
- Assumption was made that all flights that did not have a spectrum conflict would fit on the range. This needs further analysis/justification.
- Approximately 40 percent of the 46th Test Wing workload can not be accomplished on the Edwards range. The feasibility of moving these tests to the Navy ranges still needs to be studied by the Navy.

Tab A
Data from the 17 Weeks of Flight Testing from the 46 Test Wing

								Resources		
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**T**	**F**	**TM Relay**	**TSPI**	**Range Sweep**
Week 1										
WCMD-ER	Over Water Drop	WCMD-ER		X				X	X	X
SE ALE-50	Flutter			X				X	X	
SE HTS R7	CFP					X				
Week 2										
SE ALE-50	Flutter		X					X	X	
SE ALE-50	Flutter				X			X	X	
Week 3										
SE ALE-50	Flutter		X							
Week 4										
JDAM TI	Over Water Drop	GBU-31/38	X					X	X	
SE ALE-50	Flutter			X				X	X	
SE 16S350	Flutter			X				X	X	
JDAM TI	Over Water Drop	GBU-31/38				X		X	X	
Week 5										
SE WCMD-ER	CFP/Flutter			X				X	X	
SE 16S350	Flutter			X				X	X	
JDAM Enhance	Over Water Drop			X				X	X	
SE WCMD-ER	CFP				X			X	X	
SE ALE-50	Flutter					X		X	X	
Week 6										
SE F15 Trident	CFP				X			X	X	
SE F15 Trident	CFP					X		X	X	
SE F15 Trident	CFP					X		X	X	
SE F15 Trident	CFP					X		X	X	
PIDSU GBU-38 QRT	CFP					X				
PIDSU GBU-38 QRT	CFP						X			
Week 7										
SE ALE-50	Flutter			X				X	X	
PIDSU GBU-38 QRT	CFP				X					
SE 16S350	Flutter				X			X	X	
PIDSU GBU-38 QRT	CFP					X				
SE 16S350	Flutter					X		X	X	

Tab A—Continued

								Resources		
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**T**	**F**	**TM Relay**	**TSPI**	**Range Sweep**
Week 8										
SE AIM-9X	Flutter			X				X	X	
SE AIM-9X	Flutter				X			X	X	
SE AIM-9X	Flutter					X		X	X	
PIDSU GBU-38	CFP					X				
SE AIM-9X	Flutter						X	X	X	
Week 9										
Peace Xenia	Flutter					X		X	X	
SE AIM-9X	Flutter						X	X	X	
Peace Xenia	Flutter						X	X	X	
Week 10										
SE AIM-9X	Flutter		X					X	X	
Peace Xenia	Flutter			X				X	X	
SE AIM-9X	Flutter				X			X	X	
Peace Xenia	Flutter						X	X	X	
Week 11										
Peace Xenia	Flutter			X				X	X	
Peace Xenia	Flutter					X		X	X	
JDAM SE	CFP						X	X	X	
Week 12										
Peace Xenia	Flutter			X				X	X	
JDAM SE	CFP				X			X	X	
Peace Xenia	Flutter					X		X	X	
SE HTS R7	CFP					X				
SE HTS R7	CFP						X			
Week 13										
SE HTS R7	CFP		X							
SE HTS R7	CFP		X							
Peace Xenia	Flutter			X				X	X	
SE HTS R7	CFP				X					
SE HTS R7	CFP				X					
Peace Xenia	Flutter					X		X	X	
Peace Xenia	Flutter					X		X	X	
SE HTS R7	CFP					X				
Week 14										
F15E T-50 Pod	CFP		X					X	X	
F16 MA31	Captive				X					

Tab A—Continued

								Resources		
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**T**	**F**	**TM Relay**	**TSPI**	**Range Sweep**
Week 15										
CBU MI	Over Water Drop	CBU-97/ Boat Targets		X				X	X	X
SE BRU-57	Flutter				X			X	X	
CBU MI	Over Water Drop	CBU-97/ Boat Targets				X		X	X	X
SE BRU-57	Flutter						X	X	X	
SE BRU-57	Flutter			X				X	X	
SE BRU-57	Flutter					X		X	X	
SE GBU-28	CFP						X	X	X	
Week 17										
SE GBU-28	CFP			X				X	X	
SE BRU-57	Flutter			X				X	X	
SE BRU-57	Flutter					X		X	X	
SE ALE-50	Flutter					X		X	X	

Tab B
Portion of the Baseline 46th Test Wing Workload Going to Pt. Mugu

								Resources		
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**T**	**F**	**TM Relay**	**TSPI**	**Range Sweep**
Week 1										
WCMD-ER	Over Water Drop	WCMD-ER		X				X	X	X
SE ALE-50	Flutter			X				X	X	
SE HTS R7	CFP					X				
Week 2										
SE ALE-50	Flutter		X					X	X	
SE ALE-50	Flutter				X			X	X	
Week 3										
SE ALE-50	Flutter		X							
Week 4										
JDAM TI	Over Water Drop	GBU-31/38	X					X	X	
SE ALE-50	Flutter			X				X	X	
SE 16S350	Flutter			X				X	X	
JDAM TI	Over Water Drop	GBU-31/38				X		X	X	
Week 5										
SE WCMD-ER	CFP/Flutter			X				X	X	
SE 16S350	Flutter			X				X	X	
JDAM Enhance	Over Water Drop			X				X	X	

Tab B—Continued

								Resources		
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**T**	**F**	**TM Relay**	**TSPI**	**Range Sweep**
SE WCMD-ER	CFP				X			X	X	
SE ALE-50	Flutter					X		X	X	
Week 6										
SE F15 Trident	CFP				X			X	X	
SE F15 Trident	CFP					X		X	X	
SE F15 Trident	CFP					X		X	X	
SE F15 Trident	CFP					X		X	X	
PIDSU GBU-38 QRT	CFP					X				
PIDSU GBU-38 QRT	CFP						X			
Week 7										
SE ALE-50	Flutter			X				X	X	
PIDSU GBU-38 QRT	CFP				X					
SE 16S350	Flutter				X			X	X	
PIDSU GBU-38 QRT	CFP					X				
SE 16S350	Flutter					X		X	X	
Week 8										
SE AIM-9X	Flutter			X				X	X	
SE AIM-9X	Flutter				X			X	X	
SE AIM-9X	Flutter					X		X	X	
PIDSU GBU-38	CFP					X				
SE AIM-9X	Flutter						X	X	X	
Week 9										
Peace Xenia	Flutter					X		X	X	
SE AIM-9X	Flutter						X	X	X	
Peace Xenia	Flutter						X	X	X	
Week 10										
SE AIM-9X	Flutter		X					X	X	
Peace Xenia	Flutter			X				X	X	
SE AIM-9X	Flutter				X			X	X	
Peace Xenia	Flutter						X	X	X	
Week 11										
Peace Xenia	Flutter			X				X	X	
Peace Xenia	Flutter					X		X	X	
JDAM SE	CFP						X	X	X	

Tab B—Continued

								Resources		
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**T**	**F**	**TM Relay**	**TSPI**	**Range Sweep**
Week 12										
Peace Xenia	Flutter			X				X	X	
JDAM SE	CFP				X			X	X	
Peace Xenia	Flutter					X		X	X	
SE HTS R7	CFP					X				
SE HTS R7	CFP						X			
Week 13										
SE HTS R7	CFP		X							
SE HTS R7	CFP		X							
Peace Xenia	Flutter			X				X	X	
SE HTS R7	CFP				X					
SE HTS R7	CFP				X					
Peace Xenia	Flutter					X		X	X	
Peace Xenia	Flutter					X		X	X	
SE HTS R7	CFP					X				
Week 14										
F15E T-50 Pod	CFP		X					X	X	
F16 MA31	Captive				X					
Week 15										
CBU MI	Over Water Drop	CBU-97/Boat Targets		X				X	X	X
SE BRU-57	Flutter				X			X	X	
CBU MI	Over Water Drop	CBU-97/Boat Targets				X		X	X	X
SE BRU-57	Flutter						X	X	X	
Week 16										
SE BRU-57	Flutter			X				X	X	
SE BRU-57	Flutter					X		X	X	
SE GBU-28	CFP						X	X	X	
Week 17										
SE GBU-28	CFP			X				X	X	
SE BRU-57	Flutter			X				X	X	
SE BRU-57	Flutter					X		X	X	
SE ALE-50	Flutter					X		X	X	

Tab C
Portion of the Baseline 46th Test Wing Workload Going to China Lake

								Resources				
Short Title	**Mission Type**	**Remarks**	**M**	**T**	**W**	**Th**	**F**	**TM Relay**	**TSPI**	**Threats**	**Impact Cameras**	**Scoring**
Week 1												
RSAF Suite 4S	OFP	Threats/ TM/CCF		X				X	X	X		
A10 PE Suite 3	Hot Drop	Hot Drop		X								X
A10 PE Suite 3	Hot Drop	Hot Drop		X								X
A10 PE Suite 3	Hot Drop	Hot Drop			X							X
PIDSU GBU-38 QRT	Hot Drop	GBU-38			X			X	X		X	
A10 PE Suite 3	OFP	Hot Drop				X						X
PIDSU GBU-38 QRT	Hot Drop	GBU-38				X		X	X		X	
Week 2												
RSAF Suite 4S	OFP	Threats/ TM/CCF	X					X	X	X		
A10 PE Suite 3	OFP	Hot Drop	X									X
Paveway II LGB	Hot Drop	LGB		X				X	X		X	X
TASKER	Captive	Threats/ TM/CCF			X			X	X	X		
A10 PE Suite 3	OFP	Hot Drop			X							X
RSAF Suite 4S	OFP	Threats TM/CCF			X			X	X	X		
PIDSU GBU-38 QRT	Hot Drop	TM/CCF			X			X	X		X	
A10 PE Suite 3	OFP	Hot Drop				X						X
JDAM Enhance	Hot Drop	GBU-31/38				X		X	X		X	X
PIDSU GBU-38 QRT	Hot Drop	TM/CCF					X	X	X		X	
Week 3												
RSAF Suite 4S	OFP	Threats/ TM/CCF	X					X	X	X		
A10 PE Suite 3	OFP	Hot Drop	X									X
MAU-169L/B	Hot Drop	TM/CCF		X				X	X		X	X
Paveway II LGB	Hot Drop	CCF		X				X	X		X	X
A10 PE Suite 3	OFP	Hot Drop		X								X
A10 PE Suite 3	OFP	Hot Drop		X								X
RSAF Suite 4S	OFP	Threats/ TM/CCF			X			X	X	X		
Paveway II LGB	Hot Drop	CCF			X			X	X		X	X
Week 4												
A10 PE Suite 3	OFP	Hot Drop	X									X
ASEP	Hot Drop	Test Item		X				X	X		X	
A10 PE Suite 3	OFP	Hot Drop			X							X

Tab C—Continued

Short Title	Mission Type	Remarks	M	T	W	Th	F	Resources: TM Relay	TSPI	Threats	Impact Cameras	Scoring
Paveway II LGB	Hot Drop	LGB			X			X	X		X	X
A10 PE Suite 3	OFP	Hot Drop				X						X
Week 5												
A10 PE Suite 3	OFP	Hot Drop			X							X
CBU Testing	Hot Drop	CBU-97/105				X					X	X
CBU Testing	Hot Drop	CBU-97/105					X				X	X
Week 6												
Paveway II LGB	Hot Drop	LGB	X					X	X		X	X
F15K	Captive	Threats/ TM/CCF		X				X	X	X		
F15K	Captive	Threats/ TM/CCF			X			X	X	X		
Week 7												
ASEP	Hot Drop	Test Item	X					X	X		X	
F15K	Captive	Threats/ TM/CCF	X					X	X	X		
A10 PE Suite 3	OFP	Hot Drop			X							X
Paveway II LGB	Hot Drop	LGB			X			X	X		X	X
ASEP	Hot Drop	Test Item				X		X	X		X	
Paveway II LGB	Hot Drop	LGB					X	X	X		X	X
Week 8												
JDAM Enhance	Hot Drop	GBU-31/38		X				X	X		X	X
A10 PE Suite 3	OFP	Hot Drop		X								X
A10 PE Suite 3	OFP	Hot Drop			X							X
A10 PE Suite 3	OFP	Hot Drop				X						X
A10 PE Suite 3	OFP	Hot Drop					X					X
Week 9												
JDAM Enhance	Hot Drop	GBU-31/38		X				X	X		X	X
A10 PE Suite 3	OFP	Hot Drop		X								X
JDAM Enhance	Hot Drop	GBU-31/38					X	X	X		X	X
Week 10												
JDAM Enhance	Hot Drop	GBU-31/38		X				X	X		X	X
JDAM Enhance	Hot Drop	GBU-31/38					X	X	X		X	X
Week 11												
CBU Testing	Hot Drop	CBU-105		X								
MAU-169	Hot Drop	LGB			X			X	X		X	X
WCMD-ER	Hot Drop	WCMD-ER					X	X	X		X	X
Week 12												
WCMD-ER	Hot Drop	WCMD-ER		X				X	X		X	X
CBU Testing	Hot Drop	CBU-105				X		X	X		X	X

Tab C—Continued

Short Title	Mission Type	Remarks	M	T	W	Th	F	Resources				
								TM Relay	TSPI	Threats	Impact Cameras	Scoring
CBU Testing	Hot Drop	CBU-105					X	X	X		X	X
Week 13												
None												
Week 14												
JDAM TI	Hot Drop	GBU-31/38		X				X	X		X	X
JDAM TI	Hot Drop	GBU-31/38					X	X	X		X	X
Week 15												
JDAM Enhance	Hot Drop	GBU-31/38					X	X	X		X	X
Week 16												
JDAM TI	Hot Drop	GBU-31/38		X				X	X		X	X
JDAM TI	Hot Drop	GBU-31/38					X	X	X		X	X
Week 17												
CBU Testing	Hot Drop	CBU-105				X		X	X		X	X
JDAM Enhance	Hot Drop	GBU-31/38					X	X	X		X	X

APPENDIX B

Cost Data: Test Wing Consolidation

The cost tables provided in Appendix B supplement the analysis in Chapter Two. Tables B.1 through B.4 show flying hour details for both Eglin AFB and Edwards AFB. Tables B.5 through B.7 document calculations associated with the manpower analysis. Tables B.8 through B.11 show the financial implications for both flightline and backshop maintenance. Table B.12 summarizes personnel implications for the 53rd Wing.

The data were extracted from numerous sources and references. Key information was provided by the test organizations themselves. Where necessary, the numbers provided by the organizations were used as the base from which to construct additional or missing information. Every attempt was made to gather the most recent available data for all portions of the analysis. In addition, members of the organizations have reviewed the tables to ensure common understanding and agreement on the method used to arrive at the figures presented here.

The tables in this appendix were built with the intent to capture all relevant information to analyze the costs associated with the parameters of the study. Some tables may show categories that are not present in every other table. The categories of funds shown are those for which a figure was provided in any of the years under consideration. For compactness, if a category had no data for any year, it is not presented in the table. Figures for FY 2006 represent actual expenditures, staffing, billets, and numbers of hours flown (in their respective tables). Figures for years other than FY 2006 either are taken from the organization's budget documentation or are extrapolations by RAND. All numbers presented have been normalized to an FY 2007 baseline, including data for FY 2006. All adjustments were made using the appropriate Air Force factors, provided by SAF/FMC.[1] The extrapolations for recurring costs were based on the number in the last year provided, and assumed constant for the remaining years in the analysis. For instance, if RAND was provided a figure of $1,000,000 for FY 2008, this number was adjusted to FY 2007 dollars (if the number provided was not originally in FY 2007 dollars), then extended to the years 2009, 2010, and 2011. While the assumption of constant funding may not reflect actual practice, it is an appropriately conservative assumption to make in the face of the uncertainty of future year budgets. The effects of rounding should be taken into account in assessing cost data presented in the tables.

Among the references for the data presented here are reports, presentations, and personal correspondence with organization representatives. Every attempt was made to verify with the respective organizations that the figures used were those that best reflected the position of the organization, or where numbers were constructed, that the method used was appropriate. Of particular concern was the delineation between DBA and RBA funds. In the cases of several

[1] USAF Inflation Indices, issued by SAF/FMC on January 19, 2007.

facilities, the distinction has been made explicit; some facilities list DBA figures separately from RBA figures, and others may not. When no distinction is made, it should be assumed that the number includes both DBA and RBA. This assumption applies to dollar figures as well as staff, so that numbers of employees that are not otherwise delineated include those paid for through DBA or RBA, or a mixture of both.

The material in this appendix includes calculations for the net present value (NPV) of the savings accrued from undertaking the actions under consideration. The numbers were derived in the typical fashion, multiplying the value for estimated savings by the relevant factor for each year, then summing together for a total savings over the period. This study uses a 30-year horizon and thus employed a factor of 0.03, as directed by OMB Circular A-94 and in accordance with guidance from SAF/FMC on discount rates for economic analyses. It should be noted, however, that performing this calculation expands on an already uncertain assumption. The construction of the study required the assumption that every planned test was to be conserved. When customer impacts were explicitly included in the cost calculations, the behavior of customers is thus assumed to be static, with no accommodations to the changed situation. Considering an NPV figure over 30 years carries this lack of an explicit reaction to the change in costs of testing out over the same horizon. While the assumption is workable, if not entirely realistic, for considering activity over the FY 2007–2011 FYDP, the assumption is even less plausible when considering three decades. For that reason, this study relies most heavily on analysis over the FYDP. The NPV calculations are included for completeness and adherence to standard practice for cost-benefit analyses.

Table B.1
46th Test Wing Flying Hour Program, Actual Flying Hours at Eglin AFB, FY 2006

Type and MDS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Testing													
A-10	4	6	2	5	0	0	17	16	1	8	11	16	85
F-15A/D	25	18	11	6	14	25	9	22	8	4	15	15	171
F-15E	9	23	38	30	32	51	38	41	49	27	55	18	411
F-16AD	81	73	75	94	80	123	73	33	66	55	74	55	882
NC-130	0	0	0	0	0	0	0	0	0	0	0	0	0
UH-01N	6	19	0	0	28	12	15	3	18	19	10	0	129
Total	124	140	126	135	153	211	151	114	143	113	164	104	1,679
Proficiency													
A-10	3	6	14	8	21	17	6	29	12	5	18	14	152
F-15A/D	22	19	11	12	8	9	14	19	20	26	36	14	210
F-15E	18	10	17	16	18	18	28	29	23	21	35	30	263
F-16AD	58	57	60	45	43	78	56	72	89	71	69	66	763
NC-130	0	0	0	6	0	0	0	0	0	0	0	0	6
UH-01N	14	14	12	17	7	32	6	25	20	17	16	11	190
Total	115	106	113	103	97	153	109	174	164	140	175	135	1,584
TPS													
A-10	0	0	0	0	0	0	0	0	0	0	0	0	0
F-15A/D	0	0	0	6	17	0	0	0	0	19	0	0	42
F-15E	0	0	0	0	25	0	0	0	7	0	0	0	32
F-16AD	0	0	0	0	0	0	0	0	0	0	0	0	0
NC-130	0	0	0	0	0	0	0	0	0	0	0	0	0
UH-01N	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	6	42	0	0	0	7	19	0	0	74
Total per MDS													
A-10	6	12	16	13	21	17	23	44	13	13	29	30	237
F-15A/D	47	38	21	24	38	33	23	41	29	49	51	29	424
F-15E	27	33	55	46	75	68	66	70	79	49	90	47	705
F-16AD	138	129	135	139	123	202	129	105	155	125	143	121	1,645
NC-130	0	0	0	6	0	0	0	0	0	0	0	0	6
UH-01N	19	33	12	17	35	44	20	28	39	36	25	11	320
Overall total	239	246	239	245	291	364	261	288	314	272	339	239	3,337

SOURCE: 46th Operations Group.

Table B.2
46th Test Wing Flying Hour Program, Actual Flying Hours at Eglin AFB, FY 2005

Type and MDS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Testing													
A-10	0	0	0	2	5	8	2	9	0	3	3	4	35
F-15A/D	22	15	11	205	25	8	33	28	31	12	7	16	225
F-15E	13	23	35	18	18	35	21	21	35	17	13	33	281
F-16A/D	71	70	66	85	48	105	110	104	97	77	82	113	1,027
NC-130	0	0	0	0	0	0	0	0	0	0	0	0	0
UH-01N	8	0	22	17	4	8	5	7	1	0	0	6	78
Total	114	108	134	140	100	163	169	169	163	109	104	173	1,646
Proficiency													
A-10	0	0	0	0	4	5	5	17	18	17	13	12	90
F-15A/D	9	17	11	20	12	8	8	27	11	19	38	17	197
F-15E	11	16	4	5	17	23	16	15	11	14	20	10	161
F-16A/D	36	51	54	44	50	26	57	46	38	67	90	56	615
NC-130	0	0	0	0	0	0	0	0	3	6	3	0	12
UH-01N	13	5	5	3	18	22	19	5	11	0	23	61	183
Total	68	88	73	72	100	84	104	110	92	123	187	156	1,257
TPS													
A-10	0	0	0	0	0	0	0	0	0	0	0	0	0
F-15A/D	0	0	0	0	0	0	0	0	0	0	0	0	0
F-15E	0	0	0	0	0	0	0	0	0	0	0	16	16
F-16A/D	0	0	0	0	0	0	0	0	0	0	0	0	0
NC-130	0	0	0	0	0	0	0	0	0	0	0	0	0
UH-01N	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	16	16
Total per MDS													
A-10	0	0	0	2	9	12	7	25	18	19	16	16	125
F-15A/D	31	32	22	40	37	16	40	55	42	32	44	33	423
F-15E	23	38	39	23	34	58	37	37	45	32	33	59	457
F-16A/D	107	121	120	129	98	131	166	150	134	144	172	170	1,642
NC-130	0	0	0	0	0	0	0	0	3	6	3	0	12
UH-01N	21	5	27	20	22	29	24	12	12	0	23	67	260
Overall total	182	195	207	213	200	247	274	278	255	232	291	344	2,918

SOURCE: 46th Operations Group.

Table B.3
Edwards AFB Flying Hour Program, FY 2006

Type and MDS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Test and test support													
B-1	8	16	33	9	12	14	7	8			11	5	122
B-2	10	3	7	14			6	12	11	11	6	6	87
B-52			8	8	5		5			2		17	46
C-12	27	10	10	2	4	5	25	9	34	3	5	21	154
C-130	6	7	20	2		15	2	11	5	34			101
C-17	14	37	44	11	40	14	88	57	25	6	41	35	411
F-16	177	204	128	88	119	190	170	147	177	139	253	139	1,930
T-38	31	3	7		5	27	24	12	4	5	20	27	153
Tanker	24	17	22	12	10	33	15	37	26	12	20	18	244
Total	296	297	277	145	194	297	343	291	282	212	346	267	3,247
Proficiency													
B-1	16	3	2	9	8	8	6	10	11		5	20	88
B-2	7	4		2				2	2	8	4		28
B-52	16	13	14	11	12	9	1	20	3	6	5		98
C-12	35	10	15	24	20	29	22	27	12	17	24	25	260
C-130	17	7	8	4	5	17	13	9	8	14			103
C-17	11	17	5	6	8	4	3	14	14	6	3		90
F-16	80	84	85	150	81	119	87	140	101	103	106	105	1,239
T-38	36	61	48	54	45	35	54	35	36	22	39	34	499
Tanker	5	8		2	15	2	8	7	7	11	14	5	84
Total	222	207	177	263	193	224	193	253	194	187	199	178	2,489
TPS													
C-12	47	52	27	50	65	83	47	51	22	73	71	54	643
C-17								9	8				17
F-16	70	81	32	77	68	114	97	108	25	76	113	124	983
T-38	96	143	94	136	120	180	149	169	112	124	193	145	1,659
Tanker		3	4	15				6		9	10	15	63
Total	212	279	158	278	253	377	293	342	167	282	386	337	3,364
Overall total	729	783	612	686	641	898	828	886	642	681	931	783	9,100

SOURCE: AFFTC.

Table B.4
Edwards AFB Flying Hour Program, FY 2005

Type and MDS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Test and test support													
B-1	7	28	18	16	19	0	9	26	18	6	0	0	148
B-2	15	18	18									8	59
B-52	6		9	21	15	11	23	15	8	35	20	13	177
C-12	20	10	8	6	11	2	17	12	46	7	5	7	149
C-130	16	29	43	11	2	41	37	69	56	40	94	32	471
C-17	23	17	48	42	25	45	49	39	79	41	0	55	462
C-5	3	36	26	21	13	57	54	31	49	39	28	0	356
CV-22	26	9	39	41	32	38	36	31	54	45	29	52	431
F-117	37	38	25	20	19	17	31	5	19	13	15	26	265
F-15	1	8											9
F-16	185	161	183	139	160	182	214	165	279	208	199	144	2,219
F/A-22	40	34	27	11	32	78	113	15	39	18	73	31	512
H-60	13	16	2	7	0	0	0	0	0	0	0	0	38
MQ-1										14	76	62	152
MQ-9										17	22	40	79
RQ-4	7	12	38	9	14	42	35	12	101	62	121	68	521
T-38	7	2	5	2	6	7	10	0	4	3	3	2	51
T-39	0	0	0	0	0								0
Tanker	80	130	68	102	90	104	130	31	75	55	100	54	1,019
Trout	37	38	61	0	20	34	37	35	39	20	2	35	358
Vista	16	3	0	0	0	0	0	0	0	0	0	0	18
X-45	2	4	4	3	3	0	0	2	4	7	2	0	29
YAL-1A		0	6	17	5	16	11	15	18	18	0	0	106
Total	541	592	628	468	463	673	806	502	888	647	790	630	7,628
Proficiency													
B-1	1	7	0	5	7	16	4	2	4	10	9	14	79
B-2	0	0		4								9	13
B-52	8	10	2	3	7	8	10	5	9	20	6	6	93
C-12	15	45	17	15	21	22	14	36	10	23	13	16	245
C-130	18	9	2	14	23	4	4	4	53	33	36	6	205
C-17	9	3	1	2	3	12	8	17	9	27	2	5	97
C-5	0	0	0	0	0	0	0	0	0	0	10	0	10
CV-22	2	5	1	9	2	3	6	8	4	2		1	42
F-117	9	12	15	7	9	20	11	35	29	17	22	11	197
F-15	3	4	8	1	5								21
F-16	97	78	91	93	68	103	110	72	51	53	76	54	945
F/A-22	2	9	3	6	3	6	2	8	3	13	14	6	75
H-60	6	9	5	6									26
MQ-1										3	9	3	14
MQ-9											1		1
RQ-4	8	0	0	0	3	0	0	2	6	0	0	0	18

Table B.4—Continued

Type and MDS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
T-38	27	39	26	25	27	37	32	19	38	28	28	34	360
Tanker	13	9	9	8	10	5	6	8	7	0	1	5	81
Trout	6	4	13	5	3	17	15	11	4	8	7	15	107
Vista				1									1
YAL-1A											5		5
Total	222	242	192	203	190	252	222	227	226	237	240	183	2,634
TPS													
ASTTA	13												13
C-12	18	48	36	34	72	67	43	61	47	35	72	54	585
C-130			3										3
C-17		7											7
F-16	63	38	19	52	61	106	82	58	47	62	89	91	767
Lear	11	5											16
T-38	60	121	49	82	102	151	129	182	79	82	170	121	1,327
Tanker	6	3	8	0	0	0	0	0	0	8			25
Vista	7	5	0	0	20	0	1	36	8	10	32	4	123
Total	178	227	114	167	254	324	255	337	180	197	364	269	2,867
Overall total	941	1,099	939	838	925	1,248	1,283	1,083	1,302	1,097	1,393	1,093	13,239

SOURCE: AFFTC.

Table B.5
Total Support Manpower

	FY 2007 Budget	FY 2009			FY 2010			FY 2011		
		Budget	Proposal	Savings	Budget	Proposal	Savings	Budget	Proposal	Savings
AFFTC center and wing staff										
Civilians	510	510	510	0	510	506	4	510	480	30
Officers	41	41	41	0	41	41	0	41	37	4
Enlisted	21	21	21	0	21	21	0	21	18	3
CME	237	237	73	164	237	69	168	237	52	185
Total	809	809	645	164	809	637	172	809	587	222
46th Test Wing test staff										
Civilians	8	8	2	6	8	2	6	8	0	8
Officers	8	8	2	6	8	2	6	8	0	8
Enlisted	0	0	0	0	0	0	0	0	0	0
CME	1	1	0	1	1	0	1	1	0	1
Total	17	17	4	13	17	4	13	17	0	17
Flight support										
Civilians	6	6	3	3	6	2	4	6	0	6
Officers	2	2	2	0	2	1	1	2	0	2
Enlisted	12	12	9	3	12	2	10	12	0	12
CME	27	27	0	27	27	0	27	27	0	27
Total	47	47	14	33	47	5	42	47	0	47
Misc 46th Test Wing										
Civilians	99	99	58	41	99	58	41	99	58	41
Officers	8	8	4	4	8	4	4	8	4	4
Enlisted	20	20	10	10	20	10	10	20	10	10
CME	97	97	49	48	97	49	48	97	49	48
Total	224	224	121	103	224	121	103	224	121	103
46th Test Wing staff										
Civilians	79	79	14	65	79	14	65	79	14	65
Officers	3	3	5	–2	3	5	–2	3	5	–2
Enlisted	5	5	5	0	5	5	0	5	5	0
CME	58	58	5	53	58	5	53	58	5	53
Total	145	145	29	116	145	29	116	145	29	116

Table B.5—Continued

	FY 2007 Budget	FY 2009			FY 2010			FY 2011		
		Budget	Proposal	Savings	Budget	Proposal	Savings	Budget	Proposal	Savings
Total 46th and Edwards										
Civilians	702	702	628	74	702	591	111	702	552	150
Officers	62	62	57	5	62	53	9	62	46	16
Enlisted	58	58	52	6	58	38	20	58	33	25
CME	420	420	175	245	420	74	346	420	106	314
Total	1,242	1,242	912	330	1,242	756	486	1,242	737	505

CALCULATIONS:
Starting total **= 1,242**

10-percent Reduction		20-percent Reduction		30-percent Reduction	
Baseline (no.)	420	Baseline (no.)	420	Baseline (no.)	420
Less 10% of 1,242 (no.)	296	Less 20% of 1,242 (no.)	172	Less 30% of 1,242 (no.)	64
Resulting savings (no.)	124	Resulting savings (no.)	248	Resulting savings (no.)	373
Cost ($)	12,660,000	Cost ($)	24,940,000	Cost ($)	37,300,000
Nonrecurring costs ($)		Nonrecurring costs ($)		Nonrecurring costs ($)	
124 fewer contractors[a]	–2,484,000	248 fewer contractors[a]	–4,968,000	373 fewer contractors[a]	–7,600,00
20% of civilians PCS	–298,166	20% of civilians PCS	–298,166	20% of civilians PCS	–298,166
80% of civilians recruited[a]	–1,680,000	80% of civilians recruited[a]	–1,680,000	80% of civilians recruited[a]	–1,680,000
Total transition costs ($)	–4,462,166	Total transition costs ($)	–6,946,166	Total transition costs ($)	–9,578,166
Total FYDP savings ($)	37,980,000	Total FYDP savings ($)	7,482,000	Total FYDP savings ($)	111,900,000
Total effect on FYDP ($)	33,517,834	Total effect on FYDP ($)	67,873,834	Total effect on FYDP ($)	102,321,834

[a] At a cost of 20% of one year's salary per person.

Table B.6
Total Support Manpower, Cuts From CME Only ($000)

		30-percent Cut		20-Percent Cut		10-Percent Cut	
Year	Discount Factor	Cash Flow	PV Cash Flow	Cash Flow	PV Cash Flow	Cash Flow	PV Cash Flow
1	0.970873786	0	0	0	0	0	0
2	0.942595909	0	0	0	0	0	0
3	0.915141659	27,722	25,369	17,994	16,467	8,198	7,502
4	0.888487048	37,300	33,141	24,940	22,159	12,660	11,248
5	0.862608784	37,300	32,175	24,940	21,513	12,660	10,921
6	0.837484257	37,300	31,238	24,940	20,887	12,660	10,603
7	0.813091511	37,300	30,328	24,940	20,279	12,660	10,294
8	0.789409234	37,300	294,454	24,940	19,688	12,660	9,994
9	0.766416732	37,300	28,587	24,940	19,114	12,660	9,703
10	0.744093915	37,300	27,755	24,940	18,558	12,660	9,420
11	0.722421277	37,300	26,946	24,940	18,017	12,660	9,146
12	0.70137988	37,300	26,161	24,940	17,492	12,660	8,879
13	0.68095134	37,300	25,399	24,940	16,983	12,660	8,621
14	0.661117806	37,300	24,660	24,940	16,488	12,660	8,370
15	0.641861947	37,300	23,941	24,940	16,008	12,660	8,125
16	0.623166939	37,300	23,244	24,940	15,541	12,660	7,889
17	0.605016446	37,300	22,567	24,940	15,089	12,660	7,660
18	0.587394608	37,300	21,910	24,940	14,650	12,660	7,436
19	0.570286027	37,300	21,272	24,940	14,223	12,660	7,220
20	0.553675754	37,300	20,652	24,940	13,809	12,660	7,010
21	0.537549276	37,300	20,051	24,940	13,406	12,660	6,805
22	0.521892501	37,300	19,467	24,940	13,016	12,660	6,607
23	0.506691748	37,300	18,900	24,940	12,637	12,660	6,415
24	0.491933736	37,300	18,349	24,940	12,269	12,660	6,228
25	0.477605569	37,300	17,815	24,940	11,911	12,660	6,046
26	0.463694727	37,300	17,296	24,940	11,565	12,660	5,870
27	0.450189056	37,300	16,793	24,940	11,228	12,660	5,699
28	0.437076753	37,300	16,303	24,940	10,901	12,660	5,533
29	0.424346362	37,300	15,828	24,940	10,583	12,660	5,372
30	0.41198676	37,300	15,367	24,940	10,275	12,660	5,216
Totals			650,959		434,756		219,834

NOTE: Year 1 is FY 2007.

	30 Percent	20 Percent	10 Percent
Nonrecurring	(9,578)	(6,946)	(4,462)
Recurring	37,300	24,940	12,660

Table B.7
Net Present Value ($000)

Year	Flying Hour Program	Backshop Maintenance	Flightline Maintenance	
			Scenario 1	Scenario 2
1	0	0	0	0
2	0	0	0	0
3	2,856	(33,930)	11,749	11,457
4	2,772	3,397	14,880	15,723
5	2,692	3,298	14,447	20,004
6	2,613	3,202	14,026	23,025
7	2,537	3,109	13,617	22,355
8	2,463	3,019	13,221	21,703
9	2,392	2,931	12,836	21,071
10	2,322	2,845	12,462	20,458
11	2,254	2,762	12,099	19,862
12	2,189	2,682	11,746	19,283
13	2,125	2,604	11,404	18,722
14	2,063	2,528	11,072	18,176
15	2,003	2,454	10,750	17,647
16	1,945	2,383	10,437	17,133
17	1,888	2,313	10,133	16,634
18	1,833	2,246	9,837	16,149
19	1,780	2,180	9,551	15,679
20	1,728	2,117	9,273	15,222
21	1,677	2,055	9,003	14,779
22	1,629	1,995	8,740	14,349
23	1,581	1,937	8,486	13,931
24	1,535	1,881	8,239	13,525
25	1,490	1,826	7,999	13,131
26	1,447	1,773	7,766	12,749
27	1,405	1,721	7,540	12,377
28	1,364	1,671	7,312	12,017
29	1,324	1,622	7,107	11,667
30	1,286	1,575	6,900	11,329
Total	55,192	156,473	292,637	460,153
Assumed nonrecurring costs	3,823	(38,660)	3,909	3,909
Recurring cash flow	3,120	10,848	416,748	416,748

NOTE: Year 1 is FY 2001.

Table B.8
Backshop Maintenance, Scenario 1

	Baseline		Prop		Annual Savings ($000)
	Personnel (no.)	Cost ($000)	Personnel (no.)	Cost ($000)	
Civilians	7	636	82	8,200	(7,564)
Officers	0	0	0	0	0
Enlisted	2	122	0	0	122
CME	155	13,966	27	2,700	11,266
Total	164	14,723	109	10,900	3,823

NOTES: 27 CME remain at Eglin (manpower necessary to support the UH-1 and C-130). Total starting manpower is 164, all currently supporting the 53rd Wing and the 46th Test Wing.

Calculations

Total starting maintenance manpower	164	53rd Wing and 46th Test Wing
Less number remaining at Eglin	27	
Net manpower	137	
Total starting aircraft	27	16 for 46th Test Wing 11 for 53rd Wing
Number of aircraft moving to AFFTC	16	Seven F-16s Seven F-15 Two A-10s
Maintainers per aircraft	5.1	
Total number of maintainers to move with workload	81.2	People per aircraft times the number of aircraft to AFFTC
Annual savings ($000)	3,823	Annual savings
FYDP savings ($000)	(28,630)	Annual cost times 3 years less nonrecurring
Payback period (years)	10.4	Beginning in FY 2009

Assumptions:
- All changes occur in FY 2009.
- Hire all-new civilian workforce of 82 people at AFFTC.
- Reduction in force of 40 contractors at Eglin.

Nonrecurring costs	
Hire 82 civilians ($82 \times 100{,}000 \times 0.50$)	(4,100)
SE	(5,000)
Military construction	(31,000)
Total	(40,100)

Table B.9
Backshop Maintenance, Scenario 2

	Baseline		Prop		Annual Savings ($000)
	Personnel (no.)	Cost ($000)	Personnel (no.)	Cost ($000)	
Civilians	7	636	76	7,600	(6,964)
Officers	0	0	0	0	0
Enlisted	2	122	0	0	122
CME	155	13,966	27	2,700	11,266
Total	164	14,723	103	10,300	4,423

NOTES: 27 CME remain at Eglin (manpower necessary to support the UH-1 and C-130). Total starting manpower is 155, all currently supporting the 53rd Wing and the 46th Test Wing.

Calculations

Total starting maintenance manpower	155	53rd Wing and 46th Test Wing
Less number remaining at Eglin	27	
Net manpower	128	
Total starting aircraft	27	16 for 46th Test Wing 11 for 53rd Wing
Number of aircraft moving to AFFTC	16	Seven F-16s Seven F-15 Two A-10s
Maintainers per aircraft	4.7	
Total number of maintainers to move with workload	75.9	People per aircraft times the number of aircraft to AFFTC
Annual savings ($000)	4,423	Annual savings
FYDP savings ($000)	(27,849)	Annual cost times 3 years less nonrecurring
Payback period (years)	9.3	Beginning in FY 2009

Assumptions:
- All changes occur in FY 2009
- Hire all new civilian workforce of 82 people at AFFTC
- RIF 40 contractors at Eglin

Nonrecurring costs	
Hire 73 civilians ($73 \times 100{,}000 \times 0.50$)	(3,800)
RIF 66 CME at Eglin ($66 \times 100{,}000 \times 0.20$)	(1,320)
SE	(5,000)
Military construction	(31,000)
Total	(41,120)

Table B.10
Flightline Maintenance, Scenario 1

	Baseline		Prop		Annual Savings ($000)
	Personnel (no.)	Cost ($000)	Personnel (no.)	Cost ($000)	
Civilians	87	7,900	83	8,300	(400)
Officers	16	1,953	9	1,098	854
Enlisted	553	33,838	325	19,886	13,951
CME	26	2,343	0	0	2,343
Total	682	46,032	417	29,285	16,748

NOTES: 31 CME remain at Eglin (manpower necessary to support the UH-1 and C-130). Total starting manpower is 164, all currently supporting the 53rd Wing and the 46th Test Wing.

Calculations

Total starting maintenance manpower level	682	
Number remaining at Eglin	31	
Net manpower	651	
Total starting aircraft	27	16 for 46th Test Wing 11 for 53rd Wing
Number of aircraft moving to AFFTC	16	Seven F-16s Seven F-15 Two A-10s
Maintainers per aircraft	24.1	
Total number of maintainers to move with workload	386	People per aircraft times the number of aircraft to AFFTC
Annual savings ($000)	16,748	
FYDP savings ($000)	46,334	Annual savings times 3 years (FYs 2008–2011) less nonrecurring costs
Payback period (years)	0.2	Nonrecurring costs divided by annual savings

Nonrecurring costs	
PCS (20 percent of the civilians move[a])	589
80 percent of the civilians do not move	66
Hire 66 civilians at Edwards ($66 \times 100{,}000 \times 0.50$)	3,320
Total	3,909

[a] At a cost of $35,496.

Table B.11
Flightline Maintenance, Scenario 2

		Baseline		Prop		Annual Savings ($000)
		Personnel (no.)	Cost ($000)	Personnel (no.)	Cost ($000)	
FY 2009[a]	Civilians	87	7,900	84	8,400	(500)
	Officers	16	1,953	12	1,465	488
	Enlisted	553	33,838	344	21,049	12,789
	CME	26	2,343	26	2,600	(257)
	Totals for FY 2009	682	46,032	466	33,513	12,519
FY 2010[b]	Civilians	87	8,700	131	13,100	(4,400)
	Officers	16	1,953	6	732	1,220
	Enlisted	553	33,838	184	11,258	22,579
	CME	26	2,600	0	0	2,600
	Totals for FY 2010	682	47,090	321	25,091	21,999
FY 2011[b]	Civilians	87	8,700	177	17,700	(9,000)
	Officers	16	1,953	0	0	1,953
	Enlisted	553	33,838	31	1,897	31,941
	CME	26	2,600	0	0	2,600
	Totals for FY 2011	682	47,090	208	19,597	27,493

NOTE: Uses the AFFTC HPO Manpower Model. Applying this model to the workload yields a requirement of 177 civilian maintainers.

[a] Note: 31 enlisted remain at Eglin for C-130 and UH-1 maintenance. Rates are higher for Edwards.

[b] Manpower will be reduced from 466 to 177 by military-to-civilian conversion. Assume 50 percent of this savings (144.5 reduction) will occur in FY 2010.

ASSUMPTIONS:
Total number of people required: 177.
All 435 will transfer in the first year (682 total – 216 for 53rd – 31 for remaining Eglin aircraft = 435).

Calculations

FYDP savings ($000)		
Without nonrecurring	62,011	Total for FYs 2009, 2010, and 2011
With nonrecurring	53,405	Same as above reduced by nonrecurring
Payback (years)	less than 1	Nonrecurring divided by annual savings
Nonrecurring costs ($)		
20 percent of the civilians move	17	
PCS costs	596	
Remaining civilians	160	
Cost to hire civilians ($000)	8,010	Hire civilians ($160 \times 100{,}000 \times 0.50$)
Total nonrecurring cost ($000)	8,606	50 percent (4,303) in FY 2010 50 percent (4,303) in FY 2011

Table B.12
53rd Wing Personnel—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Backshop (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	0	0	0	124	124	124
Personnel cost ($000)[a]	—	—	—	11,259	11,259	11,259
Flightline (number)						
Enlisted	0	0	0	209	209	209
Officers	0	0	0	4	4	4
Civilians	0	0	0	3	3	3
Contractors	0	0	0	23	23	23
Personnel cost ($000)[a]	—	—	—	15,637	15,637	15,637
Operations (number)						
Enlisted	0	0	0	9	9	9
Officers	0	0	0	6	6	6
Civilians	0	0	0	13	13	13
Contractors	0	0	0	12	12	12
Personnel cost ($000)[b]	—	—	—	3,547	3,547	3,547
53rd Wing operations cost ($000)	0	4.35	0	0	(76.89)	(13.04)
53rd Wing maintenance ($000)	0	26.90	0	0	(475.72)	(80.69)

[a] 46 MXG, 2007.

[b] 53 WG/MO, 2007, and AFMC, 2007a, b, c.

Summary	Amount (FY 2007 $)
Nonrecurring cost	—
Annual cost, wing operations	4,347,031
Annual cost, wing maintenance	26,896,669
Nonrecurring savings	—
Annual savings	—

NOTE: This represents the sensitivity analysis that we conducted on the potential for more or less savings of staff personnel.

APPENDIX C

Cost Data: Ranges

The cost tables provided in Appendix C supplement the analysis in Chapter Three of the document. These tables cover the Eglin range (ground and open air) activities. Table C.1 summarizes the ground range activities that are individually articulated in Tables C.2 through C.10. Tables C.11 and C.12 summarize cost information for the OAR.

The data were extracted from numerous sources and references. Key information was provided by the test organizations themselves. Where necessary, the numbers provided by the organizations were used as the base from which to construct additional or missing information. Every attempt was made to gather the most recent available data for all portions of the analysis. In addition, members of the organizations have reviewed the tables to ensure common understanding and agreement on the method used to arrive at the figures presented here.

The tables in this appendix were built with the intent to capture all relevant information to analyze the costs associated with the parameters of the study. Some tables may show categories that are not present in every other table. The categories of funds shown are those for which a figure was provided in any of the years under consideration. For compactness, if a category had no data for any year, it is not presented in the table. Figures for FY 2006 represent actual expenditures, staffing, billets, and numbers of hours flown (in their respective tables). Figures for years other than FY 2006 either are taken from the organization's budget documentation, or are extrapolations by RAND. All numbers presented have been normalized to an FY 2007 baseline, including data for FY 2006. All adjustments were made using the appropriate Air Force factors, provided by SAF/FMC.[1] The extrapolations for recurring costs were based on the number in the last year provided, and assumed constant for the remaining years in the analysis. For instance, if RAND was provided a figure of $1,000,000 for FY 2008, this number was adjusted to FY 2007 dollars (if the number provided was not originally in FY 2007 dollars), then extended to the years 2009, 2010, and 2011. While the assumption of constant funding may not reflect actual practice, it is an appropriately conservative assumption to make in the face of the uncertainty of future year budgets. The effects of rounding should be taken into account in assessing cost data presented in the tables.

Among the references for the data presented here are reports, presentations, and personal correspondence with organization representatives. Every attempt was made to verify with the respective organizations that the figures used were those that best reflected the position of the organization, or where numbers were constructed, that the method used was appropriate. Of particular concern was the delineation between DBA and RBA funds. In the cases of several facilities, the distinction has been made explicit; some facilities list DBA figures separately

[1] USAF Inflation Indices, issued by SAF/FMC on January 19, 2007.

from RBA figures, and others may not. When no distinction is made, it should be assumed that the number includes both DBA and RBA. This assumption applies to dollar figures as well as staff, so that numbers of employees that are not otherwise delineated include those paid for through DBA or RBA, or a mixture of both.

The material in this appendix includes calculations for the NPV of the savings accrued from undertaking the actions under consideration. The numbers were derived in the typical fashion, multiplying the value for estimated savings by the relevant factor for each year, then summing together for a total savings over the period. This study uses a 30-year horizon and thus employed a factor of 0.03, as directed by OMB Circular A-94 and in accordance with guidance from SAF/FMC on discount rates for economic analyses. It should be noted, however, that performing this calculation expands on an already uncertain assumption. The construction of the study required the assumption that every planned test was to be conserved. When customer impacts were explicitly included in the cost calculations, the behavior of customers is thus assumed to be static, with no accommodations to the changed situation. Considering an NPV figure over 30 years carries this lack of an explicit reaction to the change in costs of testing out over the same horizon. While the assumption is workable, if not entirely realistic, for considering activity over the FYDP, the assumption is even less plausible when considering three decades. For that reason, this study relies most heavily on analysis over the FYDP. The NPV calculations are included for completeness and adherence to standard practice for cost-benefit analyses.

Table C.1
Summary Facility Data—Costs and Savings (FY 2007 $M)

Facility	Cost		Savings		30-Year NPV	FY 2007–FY 2011 FYDP
	Nonrecurring	Annual	Nonrecurring	Annual		
Base Installation Security Systems (BISS)	3.91	0.00	0.00	4.37	81.79	9.21
Gunnery and Ballistics Test Facilities (GBTF)	19.45	0.36	0.00	1.55	3.76	(15.90)
HELLFIRE Test Facility (HTF)	0.69	0.00	0.00	0.91	17.15	2.04
Kinetic Energy Munitions Test Facility (KEMTF)	1.36	0.85	0.00	0.82	(1.87)	(1.43)
Operational/Functional Ground Test (OGT/FGT)	0.60	0.00	0.00	0.45	8.30	0.77
Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF)	1.84	0.00	0.00	3.24	61.73	7.89
Simulated Test Environment for Munitions (STEM)	0.76	0.12	0.00	0.27	2.24	(0.30)
Static Munitions Test Arenas (SMTA)	0.36	0.16	0.00	0.82	12.51	1.61

Table C.2
Base Installation Security Systems (BISS)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	48	48	48	0	0	0
Personnel cost ($000)[a]	4,358	4,358	4,358	872	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	3,036	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Avoided modernization[a]	—	—	—	—	—	—
Avoided sustainment[a]	14	14	14	—	—	—

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

Summary	Amount (FY 2007 $)
Nonrecurring cost	3,907,993
Annual cost	—
Nonrecurring savings	—
Annual savings	4,372,409

NOTE: Here, and in the following pages, the subtable represents the sensitivity analysis we conducted on the potential for more or less savings of staff personnel.

Table C.3
Gunnery and Ballistics Test Facilities (GBTF)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	17	17	17	0	0	0
Personnel cost ($000)[a]	1,544	1,544	1,544	309	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	18,623	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades[c]	—	—	523	363	363	363
Avoided modernization[a]	—	—	—	—	—	—
Avoided sustainment[a]	4	4	4	—	—	—

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

[c] Knight and Taylor, 2007.

Summary	Amount (FY 2007 $)
Nonrecurring cost	19,454,847
Annual cost	363,200
Nonrecurring savings	0
Annual savings	1,547,609

Table C.4
HELLFIRE Test Facility (HTF)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	10	10	10	0	0	0
Contractors	0	0	0	0	0	0
Personnel cost ($000)[a]	908	908	908	182	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	506	—	—	—
Additional program costs	Unk.	Unk.	5.	120	Unk.	Unk.
Alternative site upgrades	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Avoided modernization[a]	—	—	—	—	—	—
Avoided sustainment[a]	2	2	2	—	—	—

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

Summary	Amount (FY 2007 $)
Nonrecurring cost	687,652
Annual cost	—
Nonrecurring savings	—
Annual savings	909,888

Table C.5
Kinetic Energy Munitions Test Facility (KEMTF)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	9	9	9	—	—	—
Personnel cost ($000)[a]	817	817	817	163	—	
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	—	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades	—	—	1,252	846	846	846
Avoided modernization[a]	—	—	—	—	—	—
Avoided sustainment[a]	3	3	3	—	—	—

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

Summary	Amount (FY 2007 $)
Nonrecurring cost	1,415,250
Annual cost	846,400
Nonrecurring savings	—
Annual savings	820,171

Table C.6
Operational/Functional Ground Test (OGT/FGT)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	5	5	5	0	0	0
Personnel cost ($000)[a]	454	454	454	91	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[a]	—	0	506	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Avoided modernization	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Avoided sustainment	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.

[a] Dyess, 2007c.

Summary	Amount (FY 2007 $)
Nonrecurring cost	596,852
Annual cost	—
Nonrecurring savings	—
Annual savings	454,000

Table C.7
Portable Seeker/Sensor/Signature Evaluation Facility (PSSSEF)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	34	34	34	0	0	0
Contractors	0	0	0	0	0	0
Personnel cost ($000)[a]	3,087	3,087	3,087	617	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	1,225	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Avoided modernization[a]	36	36	36	36	36	36
Avoided sustainment[a]	119	118	118	118	118	118

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

Summary	Amount (FY 2007 $)
Nonrecurring cost	1,842,087
Annual cost	—
Nonrecurring savings	—
Annual savings	3,243,373

Table C.8
Simulated Test Environment for Munitions (STEM)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	3	3	3	0	0	0
Personnel cost ($000)[a]	272	272	272	54	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	658	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades[c]	—	—	60	121	121	121
Avoided modernization[a]	—	—	—	—	—	—
Avoided sustainment[a]	1	1	1	—	—	—

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

[c] Knight and Taylor, 2007.

Summary	Amount (FY 2007 $)
Nonrecurring cost	772,748
Annual cost	120,800
Nonrecurring savings	—
Annual savings	273,670

Table C.9
Static Munitions Test Arenas (SMTA)—Detail

	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Personnel (number)						
Enlisted	0	0	0	0	0	0
Officers	0	0	0	0	0	0
Civilians	0	0	0	0	0	0
Contractors	9	9	9	0	0	0
Personnel cost ($000)[a]	817	817	817	163	—	—
Other costs ($000 FY 2006)						
BOS change	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Closure and cleanup[b]	—	—	111	—	—	—
Additional program costs	Unk.	Unk.	Unk.	Unk.	Unk.	Unk.
Alternative site upgrades[c]	—	—	83	163	163	163
Avoided modernization[a]	—	—	—	—	—	—
Avoided sustainment[a]	2	2	2	—	—	—

[a] 46 TW/XPR, 2007c.

[b] Dyess, 2007c.

[c] Knight and Taylor, 2007.

Summary	Amount (FY 2007 $)
Nonrecurring cost	356,492
Annual cost	163,440
Nonrecurring savings	—
Annual savings	819,705

Table C.10
Range Analysis Base Case

Cost Elements	Eglin	Edwards	China Lake	Point Mugu	Total
Cost per person ($000)	91	100	91	100	
Employees (no.)	(698)	64	10	5	(619)
Personnel transition ($000)	12,676	3,200	454	250	
Other transition ($000)		1,000	250	100	
Recurring costs ($000)			70		
Total transition costs ($000)	12,676	4,200	704	350	17,930
Total recurring costs ($000)	(63,378)	6,400	978	500	(55,500)

COST SUMMARY
FYDP: (148,572)
NPV (infinite): (1,723,807)
NPV (30-year): (981,939)

Table C.11
Range Analysis Worst-Case Excursion

Cost Elements	Eglin	Edwards	China Lake	Point Mugu	Total
Cost per person ($000)	91	100	91	100	
Employees (no.)	(459)	64	30	15	(350)
Personnel transition ($000)	8,335	3,200	1,362	750	
Other transition ($000)		1,000	250	100	
Recurring costs ($000)			70		70
Total transition costs ($000)	8,335	4,200	1,612	850	14,997
Total recurring costs ($000)	(41,677)	6,400	2,794	1,500	(30,983)

COST SUMMARY
FYDP: (77,952)
NPV (infinite): (957,625)
NPV (30-year): (543,475)

Table C.12
FYDP Savings ($000)

Cost Type	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	Total
Nonrecurring	0	0	17,930	0	0	17,930
Recurring	0	0	(55,500)	(55,500)	(55,500)	(166,500)
Total						(148,570)

APPENDIX D

Cost Data Tables

The cost tables provided in Appendix D supplement the analysis in Chapter Four. These tables cover the seven facilities that were examined in the chapter. Table D.1 summarizes the total cost and net present value calculations for the facilities that are individually examined in Tables D.2 through D.8.

The data were extracted from numerous sources and references. Key information was provided by the test organizations themselves. Where necessary, the numbers provided by the organizations were used as the base from which to construct additional or missing information. Every attempt was made to gather the most recent available data for all portions of the analysis. In addition, members of the organizations have reviewed the tables to ensure common understanding and agreement on the method used to arrive at the figures presented here.

The tables in this appendix were built with the intent to capture all relevant information to analyze the costs associated with the parameters of the study. Some tables may show categories that are not present in every other table. The categories of funds shown are those for which a figure was provided in any of the years under consideration. For compactness, if a category had no data for any year, it is not presented in the table. Figures for FY 2006 represent actual expenditures and staffing. Figures for years other than FY 2006 either are taken from the organization's budget documentation, or are RAND extrapolations from FY 2006 or FY 2007 values. All numbers presented have been normalized to a FY 2007 baseline, including data for FY 2006. All adjustments were made using the appropriate Air Force factors, provided by SAF/FMC.[1] While the assumption of constant funding may not reflect actual practice, it is an appropriately conservative assumption to make in the face of the uncertainty of future year budgets. The effects of rounding should be taken into account in assessing cost data presented in the tables.

Among the references for the data presented here are reports, presentations, and personal correspondence with organization representatives. Every attempt was made to verify with the respective organizations that the figures used were those that best reflected the position of the organization, or where numbers were constructed, that the method used was appropriate. Of particular concern was the delineation between DBA and RBA funds. When no distinction is made, it should be assumed that the number represents DBA only. This convention was also intended to apply to staff; however, personnel head counts are included primarily for information only and may not reflect DBA effort in all cases.[2]

[1] USAF Inflation Indices, issued by SAF/FMC on January 19, 2007.

[2] Because personnel costs were collected directly, this has little effect on the analysis.

The material in this appendix includes calculations for the NPV of the projected savings accrued from undertaking the actions under consideration. The numbers were derived in the typical fashion, multiplying the value for estimated savings by the relevant factor for each year, then summing together for a total savings over the period. This study uses a 30-year horizon and thus employed a factor of 0.03, as directed by OMB Circular A-94 and in accordance with guidance from SAF/FMC on discount rates for economic analyses. It should be noted, however, that performing this calculation expands on an already uncertain assumption. The construction of the study required the assumption that every planned test was to be conserved. When customer impacts, as estimated by AAC, were explicitly included in the cost calculations, the behavior of customers is thus assumed to be static, with no accommodations to the changed situation. Considering an NPV figure over 30 years carries this lack of an explicit reaction to the change in costs of testing out over the same horizon. While the assumption is workable, if not entirely realistic, for considering activity over the FYDP, the assumption is even less plausible when considering three decades. For that reason, this study relies most heavily on analysis over the FYDP. The NPV calculations are included for completeness and adherence to standard practice for cost-benefit analyses.

Table D.1
Total Costs and Net Present Value for Facilities ($000)

	FY 2006 Actuals	FY 2007–2011 Total	FY 2007–2011 Proposal	Savings	Net Present Value, 30-Year Horizon
CIGTF	15,832	89,874	114,443	(24,569)	(481,564)
GWEF	8,978	45,239	124,505	(79,265)	(1,553,633)
J-PRIMES	2,290	11,840	17,353	(5,512)	(108,043)
MCL	4,741	25,294	140,627	(115,333)	(2,260,579)
STEF	1,336	6,746	25,334	(18,588)	(364,339)
BAF	38,263	202,779	196,647	6,132	120,190
NFAC	17,046	68,585	22,183	46,402	909,503

Table D.2
Central Inertial and Global Positioning System Test Facility

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Personnel (no.)													
Civilians	88	87	87	87	43.5	87	25	87	25	87	25		
Officers	15	13	13	13	6	13	0	13	0	13	0		
RBA officers	7	7	7	7	4	7	0	7	0	7	0		
Moves (no.)													
Civilian							62						
Officer							20						
	Costs (constant FY 2007 $000)												
Recurring DBA													
Labor[a]													
In-house civilians	4,353	4,353	4,353	4,353	2,177	4,353	1,695	4,353	1,695	4,353	1,696	21,766	11,615
Other	718	784	784	784	0	784	0	784	0	784	0	3,918	784
Contract	725	824	824	725	0	725	0	725	0	725	0	3,723	824
Officers	1,874	1,587	1,587	1,587	733	1,587	0	1,587	0	1,587	0	7,933	2,319
Facilities													
Sustainment[b]	153	0	0	20	0	20	0	20	0	20	0	80	0
Restoration and modernization[c]	236	200	200	0	0	400	0	0	0	0	0	600	200
Nonrecurring DBA													
I&M CTEIP[d]				1,989		2,284		4,700		3,200		12,173	0
Civilian moves	0	0	0	0	440	0	0	0	0	0	0	0	440
Civilian RIF	0	0	0	0	2,903	0	0	0	0	0	0	0	2,903
Military moves	0	0	0	0	710	0	0	0	0	0	0	0	710
DBA subtotal	8,059	7,748	7,748	9,457	6,962	10,152	1,695	12,169	1,696	10,668	1,696	50,193	19,795
RBA	7,773	7,936	8,103	7,936	7,936	7,936	7,936	7,936	7,936	7,936	7,936	39,681	39,848
Additional costs to users	0	0	0	0	13,700	0	13,700	0	13,700	0	13,700	0	54,800
Total cost	15,832	15,684	15,851	17,393	28,598	18,088	23,331	20,104	23,331	18,604	23,331	89,874	114,443

Table D.2—Continued

SOURCES: Additional costs to users were taken from ACC study of the effects on user costs (ACC, 2006). Because the available documentation was not sufficient to identify the assumptions for these estimates, they should be considered preliminary and should be used with caution. All other data were provided by 746th Test Squadron personnel.

[a] PE 65807F/Appns 3600 and 3500.

[b] PE 65978F.

[c] PE 65976F.

[d] PE 64759F, 64256F.

GENERAL NOTES:

Civilian personnel, other in-house, and contract costs were estimated by extrapolation from FY 2006 actual costs or FY 2007 budgeted costs, as appropriate. For FY 2008, we estimated 50 percent of normal personnel costs to provide for orderly transition and closure of the facilities.

Military personnel costs are calculated by multiplying head counts by $122,042, the FY 2007 Total Annual Average Standard Composite Rate (AFI 65-503, Table A19-2, April 2006).

Facility sustainment, restoration and modernization, and improvement and modernization costs are taken from 746th Test Squadron budget projections.

Civilian and military moves and RIF costs were calculated using updated standard factors for the BRAC COBRA model from AFMC:

- cost of an average civilian move: $35,496
- cost of an average military officer move: $14.998
- RIF costs as a percentage of civilian pay (86.32 percent)
- average civilian pay: $67,806.83 (taken from the FY 2006 Median Civilian Standard Composite Rate, AFI 65-503, Table 26-1, March 1, 2006, multiplied by the March 2007 raw inflation factor of 1.025).

As discussed with AFMC, our calculations assume the BRAC percentages for personnel who would move (20 percent) versus RIF (80 percent). (Officials from various T&E centers consider this assumption optimistic.)

RBA consists of FY 2006 actuals and 746th Test Squadron projections. (In accordance with the ground rule that test requirements would remain constant, RBA was assumed to be constant between alternatives.)

Table D.3
Guided Weapons Evaluation Facility

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Civilians (no.)	33	33	16.5	33		33		33		33			
						Costs (constant FY 2007 $000)							
Recurring DBA													
Labor[a]													
In-house civilian	3,604	3,604	1,802	3,604	0	3,604	0	3,604	0	3,604	0	18,020	1,802
In-house other	816	1,033	517	1,033	0	1,033	0	1,033	0	1,033	0	5,167	517
Contract	1,417	1,209	605	406	0	1,417	0	1,417	0	1,417	0	5,868	605
Facilities													
Sustainment[b]	0	45	0	111	0	111	0	111	0	111	0	489	0
Restoration and modernization[c]	0	443	0	453	0	381	0	1,101	0	137	0	2,514	0
Nonrecurring DBA													
Civilian moves	0	0	234	0	0	0	0	0	0	0	0	0	234
Civilian RIF	0	0	2,489	0	0	0	0	0	0	0	0	0	2,489
Facility deactivation and disposal	0	0	4,030	0	0	0	0	0	0	0	0	0	4,030
DBA reimbursement	0	0	6,129	0	1,729	0	1,729	0	1,729	0	1,729	0	13,047
DBA subtotal	5,838	6,334	15,806	5,608	1,729	6,547	1,729	7,267	1,729	6,303	1,729	32,059	22,724
RBA	3,140	244	244	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234	13,181	13,181
Additional costs to users	0	0	0	0	53,500	0	14,100	0	12,700	0	8,300	0	88,600
Total cost	8,978	6,578	16,050	8,842	58,464	9,781	19,064	10,501	17,664	9,537	13,264	45,239	124,505

Table D.3—Continued

SOURCES: Facility sustainment and restoration and modernization costs are taken from 46th Test Wing budget projections. Additional costs to users were taken from ACC study of the effects on user costs (ACC, 2006). Because the available documentation was not sufficient to identify the assumptions for these estimates, they should be considered preliminary and should be used with caution. An RBA consists of FY 2006 actuals and 46th Test Wing projections. (Note that, in accordance with the ground rule that test requirements would remain constant, RBA was assumed to be constant between alternatives.) All other data were provided by 46th Test Wing personnel.

[a] PE 65807F/Appns 3600 and 3500.

[b] PE 65978F.

[c] PE 65976F.

[d] PE 64759F, 64256F.

GENERAL NOTES:

Civilian personnel, Other In-House and Contract costs were estimated by extrapolation of FY 2006 actual costs or FY 2007 budgeted costs, as appropriate. Closure assumed in mid–FY 2007, so costs under proposal are reduced by 50 percent.

Civilian moves and RIF costs were calculated using updated standard factors for the BRAC COBRA model from AFMC:

- cost of an average civilian move: $35,496
- RIF costs as a percentage of civilian pay (86.32 percent)
- average civilian pay as calculated from actual GWEF costs.

As discussed with AFMC, our calculations assume the BRAC percentages for personnel who would move (20 percent) versus RIF (80 percent). From discussions with officials from various T&E centers, this assumption is probably optimistic.

DBA reimbursement is an estimate of the costs for NAWC China Lake to assume part of the GWEF workload at IBAR (NAWC, 2007). The estimate includes the following:

- modifications to IBAR: $400,000,000
- costs of managing transfer of equipment: $400,000
- DBA salaries of 6 of 10 additional personnel: $1,229,460
- recurring maintenance of new equipment: $500,000.

Table D.4
Joint Preflight Integration of Munitions and Electronic Systems

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Civilians (no.)	6	6	6	6	6	6	0	6	0	6	0		
Enlisted	5	5	5	5	5	5	0	5	0	5	0		
						Costs (constant FY 2007 $000)							
Recurring DBA													
Labor[a]													
In-house civilian	210	210	210	210	210	210	0	210	0	210	0	1,051	420
Other in house	163	167	167	167	167	167	0	167	0	167	0	833	333
Contract	346	282	282	282	282	282	0	282	0	282	0	1,412	565
Enlisted	313	306	306	306	306	306	0	306	0	306	0	1,530	612
Facilities													
Sustainment[b]	55	54	54	54	54	54	0	54	0	54	0	268	107
Restoration and modernization[c]	100	129	129	132	132	489	0	141	0	1,269	0	2,160	261
Nonrecurring DBA													
Civilian moves	0	0	0	0	0	0	43	0	0	0	0	0	43
Civilian RIF	0	0	0	0	0	0	281	0	0	0	0	0	281
Military moves							44						44
Deactivation and disposal	0	0	0	0	0	0	7,000	0	0	0	0	0	7,000
DBA subtotal	1,186	1,148	1,148	1,151	1,151	1,508	7,368	1,160	0	2,288	0	7,254	9,667
RBA	1,104	71	71	1,104	1,104	1,137	1,137	1,137	1,137	1,137	1,137	4,586	4,586
Additional costs to users	0	0	0	0	0	0	2,700	0	200	0	200	0	3,100
Total cost	2,290	1,218	1,218	2,255	2,255	2,645	11,205	2,297	1,338	3,425	1,337	11,840	17,353

Table D.4—Continued

SOURCES: Facility sustainment and restoration and modernization costs are taken from 46th Test Wing budget projections. Additional costs to users were taken from ACC study of the effects on user costs (AAC, 2006). Because the available documentation was not sufficient to identify the assumptions for these estimates, they should be considered preliminary and should be used with caution. RBA consists of FY 2006 actuals and 46th Test Wing projections. (Note that, in accordance with the ground rule that test requirements would remain constant, RBA was assumed to be constant between alternatives.) Facility deactivation and disposal cost estimate is from Dyess, 2007f. All other data were provided by 46th Test Wing personnel.

[a] PE 65807F/Appns 3600 and 3500.

[b] PE 65978F.

[c] PE 65976F.

GENERAL NOTES:

Civilian personnel, Other In-House, and Contract costs were estimated by extrapolation from FY 2006 actual costs or FY 2007 budgeted costs, as appropriate.

Military personnel costs are calculated by multiplying head counts by $61,189, the FY 2007 Total Annual Average Standard Composite Rate (AFI 65-503, Table A19-2, April 2006).

Other Facilities Nonrecurring are civilian and military moves and RIF costs. They are calculated using updated standard factors for the BRAC COBRA model from AFMC.

- cost of an average civilian move: $35,496
- cost of an average enlisted military move: $8,877
- RIF costs as a percentage of civilian pay (86.32 percent)
- average civilian pay: $67,806.83 (taken from FY 2006 Median Civilian Standard Composite Rate, AFI 65-503, Table 26-1, March 1, 2006, multiplied by a raw inflation factor of 1.025).

As discussed with AFMC, our calculations assume the BRAC percentages for personnel who would move (20 percent) versus RIF (80 percent). (Officials from various T&E centers consider this assumption optimistic.)

For this analysis, closure of the J-PRIMES was assumed to be delayed until FY 2009 to coordinate with the relocation of flight testing, since one of J-PRIMES principal benefits to the Air Force is pre- and postflight analysis.

Table D.5
McKinley Climatic Laboratory

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Civilians (no.)	3	3		3		3		3		3			
						Costs (constant FY 2007 $000)							
Recurring DBA													
Labor[a]													
In-house civilian	79	77	0	77	0	77	0	77	0	77	0	384	0
Contract	603	1,978	0	603	0	603	0	603	0	603	0	4,390	0
Facilities												6	0
Sustainment[b]	0	54	0	256	0	256	0	256	0	256	0	1,076	0
Restoration and modernization[c]	256	770	0	788	0	0	0	386	0	0	0	1,944	0
Mothball maintenance	0	0	2,125	0	2,125	0	2,125	0	2,125	0	2,125	0	10,627
DBA subtotal	938	2,879	2,125	1,723	2,125	935	2,125	1,322	2,125	935	2,125	7,794	10,627
RBA	3,803	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	17,500	17,500
Additional costs to users	0	0	0	0	35,500	0	10,500	0	20,500	0	46,000	0	112,500
Total cost	4,741	6,379	5,625	5,223	41,125	4,435	16,125	4,822	26,125	4,435	51,625	25,294	140,627

Table D.5—Continued

SOURCES: Deactivation costs are from Dyess, 2007f. Under facilities sustainment and restoration and modernization, costs were taken from 46th Test Wing budget projections. The mothball maintenance cost is the 46th Test Wing's estimate of the annual cost of maintaining the facility in a mothball status (Dyess, 2007f). RBA consists of FY 2006 actuals and 46th Test Wing projections. (Note that, in accordance with the ground rule that test requirements would remain constant, RBA was assumed to be constant between alternatives.) Additional costs to users were taken from the ACC study of the effects on user costs (ACC, December 2006). Because the available documentation was not sufficient to identify the assumptions for these estimates, they should be considered preliminary and should be used with caution. All other data were provided by 46th Test Wing personnel.

[a] PE 65807F/Appns 3600 and 3500.

[b] PE 65978F.

[c] PE 65976F.

GENERAL NOTES:

Civilian and contract labor costs were estimated by extrapolation from FY 2006 actual costs or FY 2007 budgeted costs, as appropriate.

The 46th Test Wing estimated $10 million in additional costs per aircraft program for testing in multiple environments. THAAD impact estimated at $9 million because the complete system cannot be tested at any location other than the MCL.

Table D.6
Seeker/Signature Test and Evaluation Facility

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Civilians (no.)	4	4	0	4	0	4	0	4	0	4	0		
CME (no.)	3	3	0	3	0	3	0	3	0	3	0		
						Costs (constant FY 2007 $000)							
Recurring DBA													
Labor[a]													
In-house civilian	58	57	0	57	0	57	0	57	0	57	0	284	0
In-house other	83	299	0	82	0	82	0	82	0	82	0	629	0
Contract	180	176	0	176	0	176	0	176	0	176	0	880	0
Facilities													
Sustainment[b]	0	13	0	19	0	19	0	19	0	19	0	88	0
Restoration and modernization[c]	0	116	0	118	0	135	0	116	0	118	0	602	0
Nonrecurring DBA													
Facilities													
Deactivation and disposal	0	0	1,800	0	0	0	0	0	0	0	0	0	1,800
Other nonrecurring	0	0	211	0	0	0	0	0	0	0	0	0	211
DBA reimbursement	0	0	1,560	0	0	0	0	0	0	0	0	0	1,560
DBA subtotal	321	660	3,571	452	0	469	0	450	0	452	0	2,483	3,571
RBA	1,015	205	205	1,015	1,015	1,015	1,015	1,015	1,015	1,015	1,015	4,263	4,263
Additional costs to users	0	0	0	0	17,500	0	0	0	0	0	0	0	17,500
Total cost	1,336	865	3,776	1,467	18,515	1,484	1,015	1,464	1,015	1,466	1,015	6,746	25,334

Table D.6—Continued

SOURCES: Facility deactivation and disposal cost estimate is from the 46th Test Wing (Dyess, 2007f). Additional costs to users were taken from the ACC study of the effects on user costs (ACC, 2006). Because the available documentation was not sufficient to identify the assumptions for these estimates, they should be considered preliminary and should be used with caution. Only the first-year estimate was used to account for the cost of disruption of moving user testing in the near term. For the second year and out, we assumed no difference in user costs. All other data were provided by 46th Test Wing personnel. RBA consists of FY 2006 actuals and 46th Test Wing projections. (Note that, in accordance with the ground rule that test requirements would remain constant, RBA was assumed to be constant between alternatives.)

[a] PE 65807F/Appns 3600 and 3500.

[b] PE 65978F.

[c] PE 65976F.

GENERAL NOTES:

Civilian personnel, Other In-House, and Contract costs were estimated by extrapolation of FY 2006 actual costs or FY 2007 budgeted costs, as appropriate.

Facility sustainment and restoration and modernization costs are taken from 46th Test Wing budget projections.

Other facilities nonrecurring costs are civilian moves and RIFs. They are calculated using updated standard factors for the BRAC COBRA model from AFMC:

- cost of an average civilian move: $35,496
- RIF costs as a percentage of civilian pay (86.32 percent)
- average civilian pay: $67,806.83 (taken from FY 2006 Median Civilian Standard Composite Rate, AFI 65-503, Table 26-1, March 1, 2006 multiplied by the March 2007 raw inflation factor of 1.025.)

DBA reimbursement is an estimate of the costs for NAWC China Lake to assume the STEF workload (NAWC, 2007). In this case, we had an estimate from the 46th Test Wing for recreating the entire facility (ACC, December 2006) and an estimate from NAWC China Lake for modifying its Etcheron Valley Range to assume the STEF workload. The 46th Test Wing estimate was $5,100,000 nonrecurring. The NAWC estimate to modify the Etcheron Valley Range was $1,560,000 nonrecurring. NAWC estimated recurring costs of $1,950,000 per year, all of which was assumed to be RBA.

Table D.7
Benefield Anechoic Facility

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Civilians (no.)	32	38	38	38	74	38	74	38	74	38	74		
Officers (no.)	18	24	24	24	24	24	24	24	24	24	24		
Enlisted (no.)	3	2	2	2	2	2	2	2	2	2	2		
CME (no.)	54	62	62	62	23	62	23	62	23	62	23		
						Costs (constant FY 2007 $000)							
Recurring DBA													
Labor													
In-house civilian	3,028	3,508	3,508	3,508	7,108	3,508	7,108	3,508	7,108	3,508	7,108	17,538	31,938
Other in house	2,758	4,815	4,815	4,815	4,815	4,815	4,815	4,815	4,815	4,815	4,815	24,077	24,077
Contract	5,079	6,351	6,351	6,351	3,351	6,351	6,351	6,351	6,351	6,351	6,351	31,755	19,755
Other contract support	1,819	2,046	2,046	2,046	1,046	2,046	1,046	2,046	1,046	2,046	1,046	10,232	6,232
Officers	2,197	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	2,929	14,646	14,646
Enlisted	184	122	122	122	122	122	122	122	122	122	122	612	612
Facilities													
Sustainment	960	812	812	1,135	1,135	1,020	1,020	1,020	1,020	1,020	1,020	5,007	5,007
Restoration and modernization	812	1,312	1,312	1,285	1,285	1,000	1,000	1,000	1,000	1,000	1,000	5,597	5,597
Nonrecurring DBA													
I&M CTEIP	14,716	21,312	21,312	20,626	18,094	16,879	14,879	12,113	12,113	12,252	12,252	83,182	78,650
Other Mission	4,693	0	0	0	0	0	0	0	0	0	0	0	0
DBA subtotal	36,245	43,208	43,208	42,818	39,886	38,671	36,271	33,905	33,505	34,044	33,644	192,646	186,514
RBA	2,018	1,747	1,747	2,096	2,096	2,096	2,096	2,096	2,096	2,096	2,096	10,133	10,133
Total cost	38,263	44,955	44,955	44,915	41,983	40,767	38,367	36,001	35,601	36,140	35,740	202,779	196,647

Table D.7—Continued

SOURCES: Except as noted, all data were provided by 412th Test Wing personnel.

GENERAL NOTES:

Civilian personnel, Other In-House and Contract costs provided by 412th Test Wing personnel. Reduction of 39 contractor positions and addition of 36 civil service positions at $100,000 annual cost per position in FY 2008 and subsequent proposal years.

Military personnel, Facility Sustainment, Restoration and Modernization, and Improvement and Modernization provided by the 412th Test Wing.

Other Mission in FY 2006 is funding received for unfunded requirements in that year.

RBA consists of FY 2006 actuals and 412th Test Wing projections. (Note that RBA assumed constant between alternatives in accordance with the ground rule of holding test requirements constant.)

Table D.8
National Full-Scale Aerodynamic Complex

	FY 2006 Actual	FY 2007		FY 2008		FY 2009		FY 2010		FY 2011		Totals	
		Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	Budg.	Prop.	2007–2011	Proposed
Officers (no.)	1	1	1	1		1		1		1			
						Costs (constant FY 2007 $000)							
Recurring DBA													
Labor[a]													
Contract	3,806	2,024	1,000	7,629	0	7,461	0	7,304	0	7,156	0	31,575	1,000
Officers	0	122	61	122	0	122	0	122	0	122	0	610	61
Facilities													
Sustainment[b]	2,440	0	707	3,000	0	3,000	0	3,000	0	3,000	0	12,000	707
Restoration and modernization[c]	10,800	2,000	0	3,000	0	0	0	0	0	0	0	5,000	0
Nonrecurring DBA													
Contract award or termination	0	0	900	0	0	0	0	0	0	0	0	0	900
Military moves	0	0	15	0	0	0	0	0	0	0	0	0	15
Facilities environmental	0	0	100	0	0	0	0	0	0	0	0	0	100
DBA subtotal	17,046	4,146	2,783	13,751	0	10,583	0	10,426	0	10,278	0	49,185	2,783
RBA	0	1,400	1,400	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	19,400	19,400
Total cost	17,046	5,546	4,183	18,251	4,500	15,083	4,500	14,926	4,500	14,778	4,500	68,583	22,183

Table D.8—Continued

SOURCES: Except as noted, all data were provided by NFAC personnel.

GENERAL NOTES:

The divestiture decision was assumed to be made in October 2006, followed by a six-month transition period.

Contract costs were estimated by NFAC, with a phase-out over six months to permit orderly transition and closure of the facilities.

Military personnel costs are calculated by multiplying the head count by $122,042, the FY 2007 Total Annual Average Standard Composite Rate (AFI 65-503, Table A19-2, April 2006).

Facility Sustainment, Restoration and Modernization, and Improvement and Modernization costs were taken from NFAC budget projections. For the FY 2007 proposed budget, $707,000 is included to account for seven months of payments to NASA for the lease ("Institutional Share Pool") and for demand services.

Contract Award or Termination costs include a termination cost of $400,000 for the data system contract and $500,000 for the rotor test assembly contract.

Military Move costs are calculated using updated standard factors for the BRAC COBRA model from AFMC (the cost of moving a military officer averages $14,998).

Nonrecurring Facilities include seven months of NASA lease payments ($497,000) and seven months of NASA facility support ($210,000).

Environmental costs cover the required environmental baseline survey ($100,000).

RBA costs are NFAC projections. (Note that, in accordance with the ground rule that test requirements would remain constant, RBA was assumed to be constant between alternatives.)

Additional costs to users were not estimated because of uncertainties associated with plans of evolving customer base.

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